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1921.

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GENERAL STAFF, WAR OFFICE.



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MACHINE GUN TRAINING.

DEFINITIONS.

Arc of fire.—The zone or area of ground on to which it is desired that fire may be brought to bear from a given gun position.

"Front."—A convenient object on the ground, within the arc of fire, with reference to which the guns of a machine gun unit are ordered to be mounted.

Gun limbers.—Those limbers detailed to carry the guns, tripods and first supply of ammunition.

In action.—A machine gun is said to be in action when it is mounted with reference to the "front" and loaded.

Laying.—The process of elevating (or depressing) and traversing a gun till its axis is made to point in any given direction. On conclusion of this process the gun is said to be laid.

Observation post.—A position whence the fire of a machine gun unit is observed, corrected and controlled.

Position of readiness.—A position in which guns and personnel are assembled preparatory to coming into action.

Ranges, machine gun.—Terms applied to :—

Close range—up to 800 yards.

Effective range—from 800 to 2,000 yards.

Long range—from 2,000 to 2,900 yards.

MACHINE GUN TRAINING.

PART I.—TRAINING.

CHAPTER I.

PRINCIPLES AND SYSTEM OF TRAINING.

1. *General instructions.*

1. This manual deals with the training of machine gunners and their duties in war. The instructions which it contains and the principles which it enunciates are based on the doctrine for the organization, training and leadership of the Army, as set forth in Field Service Regulations, a knowledge of which is incumbent on every officer.

2. Any enunciation, by officers responsible for the training of machine gunners, of principles other than those contained in this manual, or any practice of methods not based on those principles, is forbidden.

2. *Organization.*

1. A machine gun platoon forms an integral part of each infantry battalion and composes No. 2 Group of the headquarter wing. It is a self-contained fire unit, capable of detachment, and comprises two sections, each of four guns. Each section is self-contained in two G.S. limbered wagons, each of which carries two machine guns and the first supply of ammunition.

Each section consists of two sub-sections each of two guns. The employment of machine guns in units smaller than a section should be avoided.

2. A machine gun troop forms part of each cavalry regiment. It is a self-contained fire unit, capable of detachment, and comprises two sections each of two guns. The guns and the first supply of ammunition are carried on pack horses, and the gun detachments are mounted.

3. Each machine gun platoon or troop has one G.S. limbered wagon carrying reserve S.A.A.

4. A gun detachment consists of the number of men detailed for the service of one gun. Each detachment is numbered from 1 to 8. A gun detachment is commanded by a gun commander (corporal or lance-corporal) who is not the firer of the gun.

5. Further details with regard to the above units will be found in War Establishments.

3. *Principles of training.*

1. The training of an army has but one object in view—the defeat of the nation's enemies in war.

The foundation of successful training is mutual confidence between all ranks.

2. All past wars have proved that victory can be won only as the result of skilled leadership and bold offensive action, while recent experience has shown that the increased decentralization of command necessitated by the power of modern weapons calls ever for increased initiative on the part of subordinate leaders, and increased tactical knowledge on the part of all ranks.

3. The success of a campaign depends, therefore, on sound training and skilled leadership, and on the degree to which, as the result of this training and leadership, the troops possess—

i. The will to go forward.

ii. The skill to defeat the enemy.

These two military qualities reinforce each other, but the one cannot replace the other; both are necessary and both can be developed. Upon their development all training for battle must be based.

4. "Machine Gun Training" deals with the general principles, both tactical and technical, which govern the training of a machine gunner. But throughout the details of training, while skill is being acquired, the fostering of moral, which includes the fighting spirit and a high state of discipline, must be borne in mind, so that the two qualities may grow together.

5. An army can exert its full power only when all its parts act in close combination. The infantry is the arm which in the end wins battles. It is the only arm which can break down the last strands of resistance and seize and hold a hostile position. But against a force of all arms equipped with modern mechanical weapons it can achieve nothing without the support of the other arms. Throughout their training, therefore, all ranks must be taught to realize the close relationship between their own rôle and that of the other arms in battle. They must understand not only the methods employed by the *infantry*, with which arm they will be most closely associated in battle; but also of the *cavalry*, *artillery*, *engineers*, *aircraft*, and *tanks*; they must appreciate the importance of close liaison and intimate co-operation during the preliminary arrangements for a battle and throughout every stage of the action.

6. It must be the aim of all officers and N.C.Os. to fit themselves to carry out efficiently the duties of the rank next higher than their own.

7. The principles of training and fighting herein enunciated are based on wide experience and are well-established. But principles on paper and apart from their application have little value. Their usefulness depends mainly upon the effort of the commander to translate them into the everyday life of his men. The virtue most to be cultivated in training, as in war, is **energy**. Energy in training, energy in fighting, pride in his work, and pride in and sympathy for his men are the commander's sure ingredients of success.

4. Object and method of training.

1. The aim of all training is to produce :—

i. In the leaders :

The ability to command—developed by actual practice in the command of men. The ability to command includes *readiness of judgment*, which can be acquired only as the result of sound military and technical knowledge, built up by study and practice until it has become an instinct. It includes the capacity for *quick decisions* and for giving clear orders, and the will-power to ensure that orders are carried out. It includes *initiative*, i.e., the ability to see when independent action is required, and the necessary *self confidence* to take such action promptly and to assume responsibility for it. Lastly, it includes the ability to execute an order through subordinate commanders without interference with their personal responsibility.

ii. In the man :

- (a) The *moral attributes* of a soldier, including patriotism, loyalty, pride of race, and a high sense of honour.
- (b) The *fighting spirit*—resolution to close with the enemy, based on confidence in their own superiority.
- (c) *Discipline*—the ingrained habit of cheerful and unhesitating obedience which controls and directs the fighting spirit. Individually, self-respect and its outward marks, such as cleanliness and a smart bearing; collectively, “team work” under the captain of the team.
- (d) *Esprit de corps*—the pride in his unit which makes a man unwilling to bring discredit on it and ready at need to sacrifice himself for its success.
- (e) *Physical fitness*—to stand the fatigue and nervous strain of marching, fighting, and working under fire.
- (f) *Skill at arms*—a thorough knowledge by every man of his weapons and their use, and thus absolute reliance upon them to kill the enemy.

These are the qualities required of a machine gunner, and they can all be developed by the methods of training described in this manual.

The growth of the moral qualities will be fostered chiefly by the environment, and it is the duty of all ranks to assist in this object by their conversation and example.

2. To be the successful trainer of a platoon*, does not primarily demand deep learning or the experience of many campaigns.

* Throughout this manual the principles laid down for the training of a machine gun platoon apply equally to a machine gun troop, where it is not otherwise specifically stated.

A good trainer requires :—

- i. Sympathy with and knowledge of his men.
- ii. An exact notion beforehand of the result he is aiming at.
- iii. Knowledge of his subject sufficient to produce this result.
- iv. Common sense in his methods.

There must be a reason clear in the trainer's mind for every lesson that he teaches. Training which is aimless is also profitless.

3. No method of training will be effective unless it possesses two essentials :—

- i. Simplicity.
- ii. Interest.

The platoon commander will secure *simplicity* by self-restraint. He must set out to teach one lesson only at a time, and he must strip his teaching of everything which does not help to drive his lesson home. Unessential details obscure the lesson and confuse the mind of the learner.

The converse of *interest* is monotony. If practice follows day after day the same unvarying lines monotony results. The lesson has lost its meaning; the learner is bored; and when the learner is bored the trainer is defeated.

The business of the platoon commander is to present to the man his daily lessons in an interesting and varied shape. They may take the form of a competition or even a game, provided it has the novelty which attracts interest and produces unmistakably the result at which he aims.

4. Novelty will not be produced without effort. The scheme of training for any day demands careful forethought and preparation, and a trainer should always explain his intentions to his subordinates and discuss with them his plans and arrangements. Training programmes are of two kinds; the programme on general lines which a commander issues for the guidance of his immediate

subordinates, and the programme in detail which a subordinate renders to his commander. The main value of any programme is for the commander who makes it. It is the written expression of his forethought.

5. The training of the platoon should not be held up because of the backwardness of one or two individual men. These men must be sent away for special instruction under a N.C.O. to bring them up to the mark, while the remainder of the platoon continues its training progressively.

6. In supervising the work of his section commanders the platoon commander must expect and look for mistakes. It is by the correction of mistakes that training progresses. Provided encouragement follows correction, criticism of faults due to slackness or neglect should be unsparing, but criticism of shortcomings after an honest attempt must be such as will produce a further and better effort.

7. The two main channels of instruction are by the eye and the ear. The usual tendency is to train too much by the ear and not enough by the eye. Talking requires less effort than action. The brain retains more readily and firmly what it sees with the eye than what it hears with the ear. The trainer must therefore call to his assistance his men's eyes as well as their hearing, and, for this purpose, his instruction should follow a definite sequence :—

Explanation—Instruction by the ear.

Demonstration—Instruction by the eye.

Execution—Testing the results of the instruction and correcting the mistakes.

Repetition—Practice to gain improvement.

8. The first and quickest method of teaching discipline is close order drill. The soldier begins his drill by being taught the "position of attention," which in itself is the key to the purpose for which

drill was invented. It secures the whole attention of the man to his commander by requiring :—

(a) Absolute silence.

(b) The body rigid and motionless.

(c) Strained expectation of the word of command, and instant readiness to obey it.

While in the position of attention the platoon places itself at the unlimited disposal of its commander. In drill movements it adds to this the instant, unhesitating and exact obedience of orders.

Thus close order drill compels the habit of obedience, and stimulates by the combined and orderly movement of the platoon the soldier's pride in himself as a soldier. It will not have these results unless smartly carried out. Slovenly drill is worse than profitless. It is the quality of the drill and not the length of time spent on it which matters. Drill should be carried out for periods of from 10 minutes to half-an-hour, but the platoon commander during the drill must insist on immediate and rigid obedience by the whole platoon to every order he gives. He thus learns to dominate their minds.

9. Strict and unvarying maintenance of unit organization in all circumstances is the surest guarantee of *esprit de corps*. On and off parade the man must work or play, not as an individual but as a member of his section, platoon or battalion. Competitions and football matches between sections or platoons stimulate pride in the unit and loyalty to it. The man will learn to "play for the side" and not for himself, and realize that the section is of more importance than the individuals who compose it. Within the section or platoon the men must know their commanders and each other. The breaking-up of sections and platoons for whatever purpose will make the men restless and dispirited. Casualties and sickness are the accidents of war and the inevitable causes of

change in a man's surroundings. It is the aim of good organization to counteract the disturbing effects of change by always giving him a home as a member of a definite unit.

Good march discipline reflects *esprit de corps*. A battalion is judged—and judges itself—by conduct on the march and by the bearing and turn-out of detached parties and individuals. Officers and men in a good marching battalion have pride in themselves. In a platoon moving well, the weaker man is unconsciously helped by the stronger man as the swing of the whole unit carries them forward. A straggler will be made to feel that he has disgraced himself and his corps.

Esprit de corps guarantees good work from a working party if it is made to realize that working is a form of fighting and equally a test of its soldierly efficiency; it ensures that the individual man, whether present with or away from his company, will bear himself in accordance with its standards.

Esprit de corps will be fostered by short and interesting lectures on the record of the regiment and machine gunners in the great war, including deeds of special gallantry, performed by individual officers and men.

10. The fighting spirit, discipline and *esprit de corps* of a unit are bound up with its physical fitness. The keen, disciplined and efficient fighting man requires a sound mind in a fit body. For this the physical exercise of drill and physical training are most valuable, but are not by themselves sufficient. Fitness of body and content of mind come more readily in the free atmosphere of games. Left to themselves when the day's work is over, the men develop a bad habit of lounging about their quarters. The platoon commander should meet this by organizing on spare afternoons or evenings football, cricket, boxing or cross-country running, especially in

competition with other platoons, and take part in them himself. The men will respond wholeheartedly and will carry the spirit of their games into their work. A platoon which plays football, runs and boxes, will not be found wanting in war. It will be qualified to meet and overcome the stress and strain of battle, of long marches, and of work under fire.

11. The platoon commander is the guardian of his platoon. It is his privilege to guard its interests at all times. He will place his own comfort or convenience second to that of his men. On reaching billets on service or on manoeuvres, he will see personally that the men are fed, and properly billeted for the night, before he looks to his own comfort. The responsibility rests with him for seeing that arrangements for supply of rations and water are working efficiently; that his sick men are seen by the medical officer, and that his eyes are open both for the malingerer and for the man who will not report sick when he should. He should know all his men and the history and personality of each. He should frequently talk to them on general topics, keep them informed of the news and see that they get papers to read. When a man becomes a casualty, the platoon commander should write to his next-of-kin and see also that his personal property is correctly disposed of. These are a few of the ways in which the platoon commander can interest himself in his men's welfare and earn a loyalty which the danger and discomfort of war will be powerless to shake.

12. **Leadership** is not born of learning. It depends on simple and straightforward human qualities. A leader, above all, must have the confidence of his men. He will gain their confidence by commanding their respect—respect for the clearness and simplicity of his orders and for the firm way in which he insists that they shall be carried out; respect for his sense of justice; for his common sense; for his keenness, energy, and habit of forethought; for his indifference to personal danger and the readiness with which he

shares his men's hardships; for his obstinate good humour in face of difficulties; and for the obvious pride he takes in his command. The leader who wins his men's confidence has won more than half his aims. He has an instrument to his hand capable of high achievement. The spirit with which he is able to fire it will carry it to success through the hardest fighting. Whatever demands he makes on it will be cheerfully and willingly met. Where he goes his men will follow him.

5. *Responsibility for training.*

(See also Training and Manœuvre Regulations.)

1. All commanders, from section commander upwards, are responsible for the training and efficiency of their officers, non-commissioned officers, men and animals.

They are also responsible that the guns, equipment, vehicles and animals under their charge are complete and fit for service.

2. The platoon (machine gun troop in the case of cavalry) is the principal training unit in machine gun organization, and it is essential that it should be regarded as a self-contained unit.

3. Machine gun units must be trained not only to act independently with the battalion to which they belong, but also to work collectively in co-operation with all arms.

Battalion commanders are responsible for the training and efficiency of their machine gun platoons as regards individual and platoon training, and that there is a capable subordinate to take the place of all commanders whenever the necessity arises.

Brigade commanders are responsible that machine gun units in their brigade are trained collectively. They will issue such instructions as will enable all machine gun units in the brigade to be concentrated for purposes of carrying out the higher forms of tactical and technical training which are essential if machine gun units are to act collectively in co-operation with all arms.

Brigade commanders are, moreover, responsible for ensuring that individual and platoon training are carried out on a uniform system within the brigade.

4. An officer will be selected to command the machine gun platoons whenever brigaded, and will be responsible for ensuring that the instruction of the brigade commander, as regards training, are carried out in all the machine gun units of the brigade. (See Sec. 83, 5.)

5. Superiors, while delegating authority for the training of subordinate units, are themselves responsible that the training is carried out in accordance with the instructions contained in this manual. They will never forego their functions of guidance and control, and will exercise a continuous supervision over the work of their subordinate commanders. The lower the unit being supervised, or the less experienced its leaders, the closer must the supervision be. In carrying out this duty, senior officers will act as directors of instruction rather than as instructors. The development of initiative of all subordinate commanders is of vital importance. Anything likely to tend to its suppression must be avoided.

6. The platoon (or troop) commander is not only responsible for the training of his platoon (or troop) as a whole, but also that the instruction of his officers is conducted in such a way as to fit them for their various duties. The character and ability of his officers and men will be largely the reflection of his own personality. He must therefore set the highest type of example in everything.

The platoon commander should encourage a spirit of self-confidence and resolution in his subordinates, and should foster their capacity for quick thinking, for readiness of judgment, and for making prompt decisions. He should make them understand that while errors caused by excess of zeal may often be pardoned, those caused by lack of initiative or reluctance to assume responsibility are invariably deserving of censure.

machine gun troops of a cavalry brigade) should be brigaded to undergo a period of training under the brigade commander's orders.

Collective training should not be commenced until proficiency has been attained in the subjects of individual training.

5. Machine gun training includes many subjects requiring close application. Lessons should be short and frequent, and instruction should be carried out in the following sequence :—

- A short lecture explaining generally the lessons to be learnt.
- Demonstration by the instructor.
- Detailed explanation by the instructor.
- Imitation by the squad.
- Interrogation of the squad by the instructor.

7. Individual training.

1. The machine gun officer must receive a thorough training in all the subjects laid down in this manual and in the handbook for the .303-inch Vickers Machine Gun.

2. The individual training of other ranks in machine gun subjects will consist of :—

i. The training of N.C.Os. and privates likely to become N.C.Os. in :—

- The duties of a gun commander.
- Elementary fire direction.
- Fire control.
- Reconnaissance.
- Map reading.
- Use of the prismatic compass.
- The tactical employment of the gun.
- The writing of messages and reports.
- The subjects laid down in (ii) below.

ii. The training of privates in :—

All the subjects laid down in Part I of this manual.
Mechanism, &c. (Handbook for the .303-inch Vickers Machine Gun).

The use of the revolver.

Defence against aircraft.

iii. The training of drivers in :—

Riding, driving and stable management.

Use of ground.

Tactical use of limbered wagons in the field.

iv.—(a) *Artificers*.—Will be selected from men who have worked at their trade before enlistment, and will receive a course of training at the Artillery College under the provisions of King's Regulations para. 744 and Appendix XX.

(b) *Shoeing smiths*.—Will be trained at the School of Farriers, Woolwich.

(c) *Rangefinders*.—Will be trained in the unit. Officer and N.C.O. instructors will be trained at the Machine Gun School.

(d) *Signallers*.—Officer and N.C.O. instructors will be trained at the Army Signal School; other ranks will be trained in the unit.

3. Training in the use of the revolver will be carried out in accordance with the instructions contained in Musketry Regulations, Part I.

Officer and N.C.O. instructors will be trained at the Small Arms School.

A certain proportion of the personnel in every gun detachment is armed with the revolver, and as all the numbers of a gun detachment

must be interchangeable, it is essential that every machine gunner should be trained in the use of the revolver.

4. The efficiency of machine guns so largely depends on the skill of the drivers and on the training and condition of the mules and horses that the maintenance of a high standard of equitation, driving and horsemastership is essential in all machine gun units.

The limbered wagon is to the machine gun as the limber to the field gun.

Complete tactical value cannot be obtained from machine guns without the ability to manoeuvre limbers boldly and skilfully under fire. This demands highly trained officers, drivers and teams. Such handling of limbers will effect a great saving of physical strain on the part of gun detachments.

Instruction in horsemanship, equitation and driving will be carried out in accordance with the instructions contained in Artillery Training, Vol. I, which are suited to the needs of machine gun units.* It must be remembered that machine gun limbers are required to work closer to the enemy than field guns; faults in driving may lead to more fatal results with machine guns than with artillery. The standard required of drivers in machine gun units is, therefore, at least as high, if not higher, than that necessary for artillery drivers.

5. The musketry training of a machine gunner will consist in firing Table "C" Annual Course of Musketry (see Addendum No. 7 to Musketry Regulations, Part I), with the necessary preliminary drills for that purpose.

8. Section training.

1. The platoon commander will allot such time as he considers desirable at the beginning of the annual course of training in field

* The training of machine gun troops in these subjects will be carried out in accordance with the instructions contained in Cavalry Training.

operations for the training of his sections. He will personally supervise this training and thus ensure that each section is fit to take its place in the platoon.

2. All N.C.Os. and men of the section must be present for this training.

3. Platoon commanders will prepare, in accordance with instructions issued by the infantry battalion commander, a programme of work to be carried out during the period allotted for section and platoon training.

4. Success in battle will largely depend upon the efficiency of fire unit commanders. The normal fire unit will be the section. The practical training of all section commanders is therefore of supreme importance, and with this object every section should be regarded as a distinct unit and should be commanded throughout its training by its own leader.

In all circumstances, platoon commanders are responsible that not only all section commanders, but also section sergeants, are given such practice in command as will make them efficient fire unit commanders.

5. It will be an advantage if during the period allotted to section training, one day a week is given up to carrying out a platoon exercise suited to the stage of training reached by the sections.

9. Platoon training.

1. During the first months of the collective training period, each platoon will be struck off all duties for a special course of training in field operations (see Chapter VII), and for the annual machine gun course, and annual course of musketry and revolver training.

2. To secure efficiency in the command of a platoon it is essential that its training should be devoted to ensuring that its component parts work together as one harmonious whole.

The chief points to which the platoon commander should devote his attention are :—

- i. Fire discipline and fire control.
- ii. Supply and replenishment of ammunition.
- iii. Internal communication within the platoon, and co-operation between the various members of platoon headquarters.
- iv. Fire tactics (the selection, occupation and preparation of gun positions and co-operation with other arms).
- v. Field engineering.
- vi. The training of section commanders in the solution of tactical problems.

3. At first it will often be advisable to take out only the officers, senior N.C.Os. and parties required for observation and communication. When these individuals have got to know their work and to understand each other, the whole platoon can be taken out.

Parties may with advantage be sent out to the positions against which the guns are to come into action to note where and when any of the personnel or material of the platoon are exposed to view, and to form targets for the guns. By such means the men will be enabled to see the mistakes made, and learn to avoid them.

4. The difficulties which attend the supply of ammunition in the field make it important that each platoon should practise it with its full number of limbered wagons as often as possible. In order to do this, arrangements should be made by the infantry battalion commander to place the necessary animals and vehicles at the disposal of the platoon commander.

5. Before the training of the platoon is finished an opportunity of bivouacking for 24 hours should be obtained. It will be of

advantage if the site selected affords facilities for practising swimming horses and mules, entrenching and the passage of obstacles.

6. All training, other than formal parades, carried out beyond the precincts of barracks, whether other arms are present or not, should be based on some simple tactical scheme, which should be explained to all ranks beforehand.

7. It will be of great advantage if the later stages of this period of platoon training synchronise with the battalion training of the infantry battalion of which the machine gun platoon forms part.

10 *Brigade machine gun training.*

1. As soon as the platoons have completed platoon training they will be inspected by the brigade commander, after which the training of the brigade machine guns as a whole should be carried out for such time as the brigade commander may direct.

2. The object of this training is to fit the machine guns of the brigade to take part in any operation involving the employment of other arms.

To achieve this object, training in the following is necessary :—

- i. The selection and change of positions and of objectives, in accordance with the tactical plan.
- ii. The distribution of fire, in accordance with the progress of the fight, and the procedure to be adopted for this purpose.
- iii. Co-operation with the other arms, and inter-communication between the brigade machine gun commander, his platoons and ammunition supply, and also between the brigade machine gun commander and brigade headquarters and subordinate infantry commanders.

3. If arrangements cannot be made to carry out tactical training with the other arms, the action and effect of those arms must be considered in the solution of tactical problems.

4. Whenever possible a field-firing area should be allotted for the use of the brigade machine guns at the end of this period of training.

The object is two-fold, viz. :—

- i. To instruct all ranks in the application in the field of the approved principles of machine gunnery and machine gun tactics with service ammunition.
- ii. To accustom commanders to acquire the habit of appreciating a situation quickly and correctly, of arriving at an immediate decision, of translating that decision into suitable orders, and of ensuring their intelligent and rapid execution.

The schemes on which the tactical practice is based should deal with problems such as are likely to confront a commander in war. These schemes will be drawn up by the officer selected to command the brigade machine guns, under the instructions of the brigade commander, who should be present at the tactical practice and act as director of the operations.

5. During winter training schemes should also be framed for the purpose of training machine gun officers in the tactical principles laid down in Field Service Regulations, Vol. II; Infantry Training, and Machine Gun Training. These exercises should be prepared in detail with maps, instructions and points for criticism. They should involve the rapid appreciation of a situation, the selection of the most appropriate method of fire direction, the issue of orders, the sending of situation reports and the rapid preparation of sketch maps. The actual presence of guns on such tactical schemes is of value in order to test, to some extent, the feasibility of the execution of the orders given. Their presence, however, is not essential for the conduct of the exercise.

CHAPTER II.

INDIVIDUAL TRAINING.

11. *Visual training ; indication and recognition of targets.*

1. *Visual training* will be carried out as laid down in Musketry Regulations.

Frequent practice in the examination of ground should be given during the later stages of individual training. This should at first be confined to the recognition of natural and artificial features and the general character of the country ; next, the importance of these features should be pointed out with reference broadly to the attack and the defence of the area in which they lie ; and, finally, attention should be called to those which are of particular interest to the machine gunner, *e.g.*, positions for observation to the front and to the flanks, positions that offer a good field of fire, areas on which observation of fire is likely to be obtained, localities from which hostile attacks may develop, the visibility of sky-lines, &c. By such practice a necessary introduction will be obtained to the more detailed study of cover, reconnaissance, and the selection of gun positions (Sec. 41).

2. *Indication and recognition of targets.*—It is essential that the target should be described in such a way that the firer will recognize without delay the exact point of aim indicated to him. Owing to the close grouping of machine gun fire, even small inaccuracies may result in total loss of fire effect, and, since machine gun fire is

often delivered under conditions where the safety of the infantry or other troops has to be considered, a wrong point of aim may result in danger to our own troops.

3. At the conclusion of a movement, or when occupying a position, well-defined description points will be selected and indicated to Nos. 1 and 2 of each gun. Targets will, when necessary, be described with reference to these description points, the lateral and vertical distance from the description point to the target being measured by the angle (degrees or minutes) subtended at the eye. When describing a target bearing obliquely from a description point, the bearing will be notified either by the above method, or, if the nature of the ground makes it simpler, by reference to the position of figures on the dial of a clock, the description point being regarded as the centre of the dial. The angles as found can also be laid off at the gun by means of the direction and elevation dials.

Lateral measurements less than 15 minutes should not be given.

When the above system is employed, the line of sight on the gun is brought into the close vicinity of the target. The gun must then be laid on a definite aiming mark, which must be further described.

4. The number of description points selected will depend on the nature of the country, but, as a general rule, description points at intervals of not more than 30 degrees should be selected. These points, if possible, should not be nearer to the gun position than the probable targets.

5. The angles are measured by means of graticuled glasses or cards, or by the angles as subtended by the various parts of the hand when placed at arm's length. All officers, N.C.O.s. and men should know the "hand-angles," which vary with the individual.

Thus:—Thumb and fingers extended, about 19 degrees, fist clenched, about 8 degrees, the various knuckles, etc.

For the purpose of instruction a degree scale, calculated for a given distance and painted on a wall, will be found useful. A more convincing method can be demonstrated by the use of the dial on the gun.

6. Landscape targets should be used for the preliminary lessons in the methods of describing targets, and to give practice in quick and accurate laying on the points described.

12. Range-finding.

Range-finding is the process of determining the distance in yards to a given target.

1. Methods of range-finding:—

i. Instrument.—At least one man in each gun detachment will be specially trained in the use and adjustment of the range-finding instrument. At least one officer in each platoon or troop and one N.C.O. in each section should also be so trained, and every opportunity should be taken of practising all ranks in its use.

The mean error in range-finding by specially trained men by this method should not exceed 3 per cent. of the range for distances under 2,000 yards.

ii. Maps.—This method is valuable when maps of large scale and known accuracy are available, and, if these are read correctly, the error should be negligible.

The error that may arise owing to the inaccuracy of a map should not exceed 5 per cent. of the range.

iii. Judging distance.—Preliminary training will be carried out as laid down in *Musketry Regulations*.

A special study will be made of the 500 yards and 800 yards ranges in order that the machine gunner may

appreciate the distance at which to use the "fixed sight" on his gun, and may distinguish the limit of close range (800 yards.)

Officers and N.C.Os. will be taught to judge distance up to 1,500 yards inclusive. They will make a special study of the following ranges:—

- (a) 600 yards. Ability to estimate this distance will be of assistance to officers and N.C.Os. in the reconnaissance of a position in defence (see Sec. 117, 1 (d)).
- (b) 800 yards and 1,500 yards. In order that a correct estimate may be made as regards the field of fire required (see Sec. 117, 1 (a)).

At distances beyond 800 yards it is inadvisable to rely on judging distance as a means of ranging unless observation of fire is possible and surprise effect is of secondary importance.

As, however, the determination of the number of guns necessary for fire effect depends to a large extent on the field of fire and range, officers are required to study those distances which are mainly affected by fire direction.

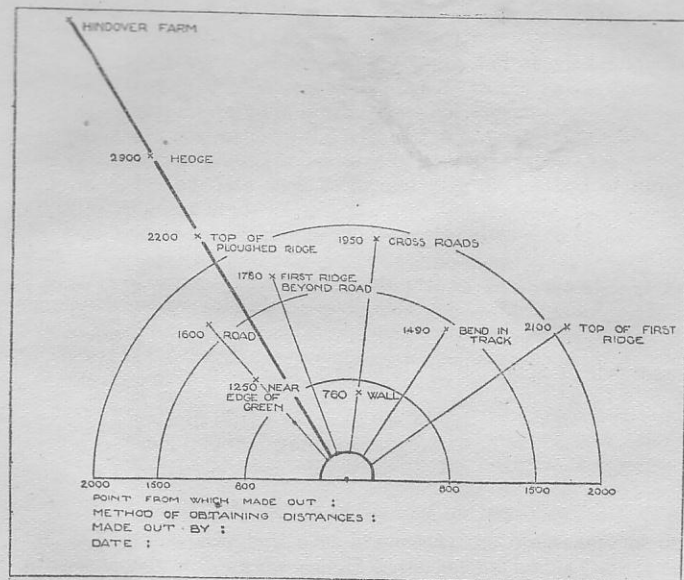
The inability of officers to appreciate distances on the ground in conjunction with the problem of fire direction can only result in the loss of fire power at the longer ranges.

iv. Range cards.—In this method, objects are marked to which the range (key range) can be accurately obtained by either of the first two methods, and intermediate distances are estimated. (Plate I.)

For these intermediate distances the error should not exceed 10 per cent. of the range.

[To face page 26.]

PLATE I.—RANGE CARD.



2. Points to be observed in making a range card :—

- i. The position from which the range card is taken must be clearly defined.
- ii. Draw three semi-circles with radii representing 800, 1,500 and 2,000 yards respectively.
- iii. Draw a thick setting ray to a prominent object, which should be as far away as possible.
- iv. Rule lines of proportionate length, and at correct angles.
- v. Describe each object as it appears to the naked eye.
- vi. Write all words in block letters horizontally.
- vii. Place the range on the left of each object.
- viii. Mark in points or features of tactical importance.
- ix. Sign and date each card, and give the method of range-finding used.
- x. Ensure that each gun number recognizes each object.

Breadth of target.—This can be obtained by various methods, the simplest being the following :—

- (a.) From the map.
- (b.) By hand angles or graticules, if the range to the target is known. One degree subtends a distance equal to one-sixtieth of the range to the target, or about 5 feet for each hundred yards of range.

13. *Observation of fire and ranging.*

1. *Definition.*—Observation of fire means the observance of one or more bullets striking the ground or the enemy, and is a necessary preliminary to ranging or registering, which is the process of determining by observation of fire the direction and elevation required to hit a given target.

2. Observation of fire must be taught as part of the practical side of fire direction. Once fire has been opened subsequent fire orders depend on the results of observation. Slow and faulty observations of fire will result in loss of fire effect.

Endeavours to teach observation of fire against a stop butt on a classification range are of little value. A stop butt permits of a beaten zone of about two or three yards. Beaten zones may be several hundreds of yards in length in the field.

Observation of fire exercises should be carried out on a *field firing* range whenever possible.

Greater value will accrue from observation practices if results can be signalled or telephoned to the firing point by observers posted under cover in the vicinity of the area engaged. In this connection it must be realised that observation practices form the connecting link between theoretical fire direction and field practices.

3. Observation of fire for indirect fire is as important as for direct fire, and must be sought for whenever the target area can be observed.

4. It is important that thorough grounding in the following subjects shall have been given before preliminary instruction in observation of fire is commenced :—

- (a) Practical knowledge of machine gun beaten zones at short, medium and long ranges.
- (b) Appreciation of ground likely and unlikely to give observation of the bullet strike.
- (c) Sufficiently long bursts of fire (i) to enable the area to be sufficiently covered with bullets to form a reliable beaten zone, (ii) to give the observer sufficient time to "find" a portion of the beaten zone and appreciate or "find" the remainder of the beaten zone.

(d) Visual training.

(e) Use of field-glasses and range-finding instrument to watch an area.

5. Since they must be able to apply fire from their own observation when superior control no longer exists, all machine gunners must be taught to observe the fire of one gun at ranges up to 800 yards.

6. The nature of the ground, atmospheric conditions and other factors alone can determine the range up to which it may be possible to observe the fire of a single machine gun. Too much reliance, however, except under very favourable conditions, must not be placed on observation when the observer is the firer at ranges beyond 800 yards.

An observer with field glasses will often be able to observe accurately up to 1,500 yards.

7. When fire is observed to be striking a point short of or beyond the target, corrections will be made by means of the elevating wheel. When it is seen that the desired point is being struck, the slide of the tangent sight will be adjusted so as to give a line of sight to that point.

When using the "fixed" sight, corrections will be made as above, but as no adjustment of the sight is possible, the point of aim necessary to strike the target must be noted, and subsequent relaying must be made on that point.

8. *Preliminary instruction* must be given progressively, and should consist of :—

- (a) Demonstrations of the zones of fire with tracer ammunition at, say, 500 and 800 yards.
- (b) Demonstrations of the beaten zones at, say, 500, 800, and 1,000 yards, with ball ammunition.

- (c) Marking the extremes (length and breadth) of beaten zones at, say, 500 and 1,000 yards, by flags or fatigue-men.
- (d) The study of the beaten zone area, and ground in the vicinity, with a view to possible observation of fire, and the training of the gunner to "observe" that *area* rather than a definite aiming mark.
- (e) The application of fire as a result of observation. Errors in elevation and direction can be assumed and marked by a flag or fatigue-man, representing the centre of the beaten zone or a fringe of the beaten zone observed. Deliberate and quick methods of altering the elevation will be practised.

9. *Individual training with ball ammunition* will be carried out during "individual" firing instruction between Part I. M.G. Course and the classification practices of Part II. M.G. Course, and will include :—

- i. Observation of the beaten zone. Ranges 600 to 800 yards (approximately) :—
 - (a) Flat ground (for normal beaten zones, *see* Appendix I.)
 - (b) From a position having "command" or against a forward slope. (Beaten zone is reduced, *see* Sec. 49.)
 - (c) From a commanding position and against a forward slope. (Beaten zone is much reduced.)

Targets should be placed on a crest, so that only the lower half of the beaten zone can be seen; on ground likely to give observation short but not beyond, and similarly on ground likely to give observation beyond but not short; on ground which, owing to small undulations, produces defiladed areas and causes the beaten zone to be patchy, thus making it difficult to pick out the "nucleus." In these exercises the firer carefully searches the *area*

with his eyes, picks out the "nucleus" and applies fire.

- ii. Observation of the beaten zone. Ranges 800 to 1,200 yards. As in (i), but the power of the firer to observe his fire may be limited before 1,200 yards is reached.

10. Under favourable conditions, a burst of 15 to 20 rounds will often be sufficient to determine the nucleus of a beaten zone: when, however, the conditions are unfavourable for observation it may be necessary to fire bursts of 40 to 50 rounds (*see* para. 4 (c) above).

NOTE.—For collective (*i.e.*, section) training in observation of fire *see* Sec. 35, para. 11.

14. *Signals.*

1. The machine gunner will receive instruction during his recruit training in the signals laid down in Infantry Training, Vol. I. The following machine gun signals will be used for controlling movements and fire :—

"Action."—Both arms, fully extended, raised from the sides to a position in line with the shoulders and lowered again. This motion to be repeated until it is seen that the signal is being complied with.

"Out of action."—Arm swung in a circular motion in front of the body.

"Gun ready to fire."—The No. 2 will extend his left arm horizontally.

"Stand by, ready to fire."—The controlling officer will raise his hand.

"Fire."—The controlling officer will drop his hand. The No 2 will tap the No. 1 lightly on the back and order "Fire," and will then lower his left arm.

"Cease fire."—The controlling officer will wave his forearm horizontally, elbow close to the side. The No. 2 will tap the No. 1 lightly on the back, and order "Cease fire."

2. The following semaphore code will be used to convey :—

i. *Orders*—

U	...	...	Up 50 yards (or up 10 mins.).
N	...	...	Down 50 yards (or down 10 mins.).
T	...	...	30 mins., more right.
L	...	...	30 mins., more left.

To double or further increase the above corrections, the code letter will be repeated as necessary.

ii. *Information*—

K	...	...	Fire observed correct.
Q	...	...	Fire unobserved.
B	...	...	More ammunition required.
W	...	...	More water required.
H	...	...	Limbers to come up to gun position.

15. *Fire orders.*

1. Before fire orders can be practised, a high standard of training must have been reached in the subjects contained in the previous sections of this chapter. In addition, officers and N.C.Os. must possess a sound knowledge of fire direction. A fire order is the final précis of the solution of a fire direction problem, and it is in this form that a task is conveyed to the firers. Therefore, unless definite, concise and easily understood orders are issued, the solution of fire direction problems is rendered valueless.

2. In the early stages of training in this subject attention will be paid to accuracy, rather than to speed. The training will be pro-

gressive, beginning with the simplest of orders and leading gradually to the more advanced orders. The first lessons may be given on the landscape target, but every opportunity must be taken of giving practice in the open country. On all occasions *service targets* must be indicated.

3. *Delivery of fire orders.*

i. *Sequence.*—A prearranged sequence makes for conciseness, prevents important points being omitted and enables the firers to act with certainty on receipt of an order.

The following sequence is applicable to all orders, whether fire is direct or indirect.

ii. *Orders to open fire* :—

- (a) Range or ranges (when firing indirect the Q.A. should follow (d) below).
- (b) Dials (if considered necessary).
- (c) Indication of target or aiming mark.
- (d) Nature of fire (if applicable e.g., "Distribute").
- (e) Executive order "Fire."

iii. *Orders during firing* :—

- (a) Deflection (e.g., 2 degrees more right).
- (b) Elevation (e.g., up 10 mins., or up 50 yards).

iv. *Orders to cease fire* :—

- (a) Cease fire.
- (b) New target (indirect fire only).

v. *Method of delivery* :—

- (a) In writing.
- (b) Verbally through orderly or connecting file.
- (c) By word of mouth.

Whenever possible anticipatory orders, in which the range and target are given before the occasion for firing arises, should be given to the gun commanders.

When dealing with fleeting targets method (b) will generally have to be used, (c) being employed when circumstances are favourable.

Method (c) although valuable from a drill point of view is often impossible on service for the following reasons:—

Difficulty of hearing the order owing to noise, which may lead to misinterpretation.

As the position of the fire unit commander must be chosen within shouting distance, it may not be suitable for observation of fire, movements, &c.

Note.—When degrees or minutes are incorporated in a verbal order, they should be given out by separate numerals, e.g. "Five seven degrees," not "Fifty seven degrees."

vi. *Position of the Commander.*

The position of the commander should enable him to:—

- (a) Observe fire.
- (b) Observe the movements of the enemy.
- (c) Observe the position of our own troops.
- (d) Communicate with the fire unit.

vii. *Training.*—Fire orders demand on the part of the commander quick appreciation of the nature and volume of fire required, and skilful observation of fire together with good "indication."

Constant practice is necessary, and failure to obtain fire effect with trained personnel is a reflection on the commander.

Training must ensure all types of targets being engaged:—

- (a) Targets of limited width and depth.
- (b) Targets possessing considerable depth but little width.
- (c) Linear targets.
- (d) Oblique linear targets.
- (e) Areas.

4. Execution of fire orders.

Practice in the execution of fire orders is designed to inculcate implicit obedience and prompt action on the part of the No. 1. It will also serve to quicken his intelligence and power of observation. The repetition of orders by No. 1, and the transmission to him of signals by No. 2, must always be insisted upon, and any laxity immediately checked.

Careful training will be required in the execution of orders involving the use of traversing, searching and combined sights.

16. Allocation of duties.

1. The duties of troop, platoon and section commanders are to command their troop, platoon and section respectively in accordance with their orders and the tactical situation, to observe and control fire generally, to regulate the ammunition supply, and to give instructions regarding the movements of their pack animals or limbered wagons.

2. The duties of the serjeants are to command a sub-section in accordance with the orders of the section officer. The senior sub-section serjeant must be prepared to take command of the section in the event of the officer becoming a casualty.

3. The duty of an N.C.O. in charge of the limbers is to supervise packing and unpacking. He will have the spare parts box handy, supervise the ammunition supply, direct the gun limbers as required, and he must keep in touch with the section officer. In the case of cavalry machine guns, the corporal will be in charge of the led horses and will perform duties similar to those mentioned above.

4. The following are the duties of the various numbers:—

No. 1 is the firer. He will personally clean and look after his gun, and ensure that the mechanism is working smoothly. On going into action he will carry the Mark IV tripod and place it in

position, and assist No. 2 in mounting the gun. He repeats all orders received, observes his own fire when possible, as well as the movements of our own troops and of the enemy. He will only make alterations of direction and elevation when ordered to do so.

No. 2 carries the gun into action and assists No. 1 to mount it. On going into action he will secure the condenser tube to the gun, and will carry the spare parts case. He will attend to the feeding of the gun, watch for signals from the officer, and generally assist No. 1.

No. 3 is responsible for keeping the gun supplied with ammunition, seeing that the condenser bag (half-filled with water) reaches the gun position before the water in the barrel casing boils, and for carrying out minor repairs whilst the gun is in action.

No. 4 assists No. 3 in his duties. He is responsible for keeping No. 3 supplied with ammunition, water, oil and spare parts as required.

The remaining numbers will act according to the orders of the section officer.

In cavalry machine gun units No. 5 is a horseholder, No. 6 a scout and No. 7 a range-taker.

5. The duties of a N.C.O. acting as "gun commander" are to supervise generally the firing of the gun. In carrying out indirect fire, he will see that the correct direction and elevation are placed and maintained on the gun. He must watch for signals from the controlling officer.

6. Section officers will ensure that each man of the section is thoroughly trained in the duties of each "number." A system of "changing round" will be arranged, so that every man will perform the several duties of the section in turn.

CHAPTER III.

MACHINE GUN DRILL.

17. *Aiming instruction.*

The soldier must be instructed on the lines laid down in this section before he commences "sight setting and laying" in elementary gun drill.

1. Kit required: Gun, tripod, belt box, aiming disc, miniature bull's eye target, figure and landscape targets.

2. The instructor should first impress upon the squad the importance of correct aiming, from the machine gun point of view.

3. The use of the sights—to obtain direction and elevation—will be explained.

4. The method of adjusting the sights will be demonstrated and explained. Fifty yards will be taught as the smallest adjustment. The instructor should impress upon the men that the correct line on the graduated plate for any particular range is the one *under* the figures indicating that range. The men should be required to make several adjustments.

5. The following rules for aiming will then be given, and diagrams used to make the explanation clear:—

- (a) Sights upright. This is obtained by correct mounting of the tripod (*see* Sec. 13, para. 7).
- (b) Master eye used.
- (c) Blade in centre of "U," and tip in line with shoulders.

(d) Subject to atmospheric conditions, aim will be taken at that part of the target on which it is desired the nucleus of the beaten zone shall fall. In the case of aiming marks of such a nature that, if attempt is made to aim at the centre, the mark itself is obscured by the foresight, a lower aim must be taken in order to obtain a clear definition of the aiming mark.

(e) Eye about 6 inches from rear crosspiece.

6. A miniature bull's eye target will then be placed about 10 yards away. The instructor will lay a correct aim without "holding." He will explain that direction is obtained by tapping the traversing handles, and that the elevating wheel must be turned in order to elevate or depress the gun. Whilst laying, the chin must be supported on the hand. A belt box may be placed across the knees and the elbows rested on the box, or the box may be placed on the ground, resting on end, and the arms rested on the top.

7. Every man should then view the aim, after which the men themselves, in turn, will lay the gun. They will not "hold" the gun during this lesson. The reasons for taking a regulation aim should be explained.

Should any faults be detected, the instructor will point out what effects they would have on shooting, and will see that such faults are remedied.

8. When sufficient progress has been made, the correct method of "holding" the gun will be shown and explained. The following points in connection with "holding" should be impressed upon the men:—

(a) The correct method of holding the traversing handles is with the third and little fingers round the handles, second finger behind the safety catch, forefingers on top, and thumbs resting lightly on the thumbpiece; except when

the gun is laid, when the safety catch should be raised with the second fingers.

(b) The elbows should, whenever possible, be supported by the inside of the thighs.

(c) That there should be practically no difference in aim with or without holding.

9. When the men can aim correctly, using a bull's eye target, similar practice will be given on figure targets, then on landscape targets, and finally on natural features in the open country.

A perfect aim must be insisted upon at all times.

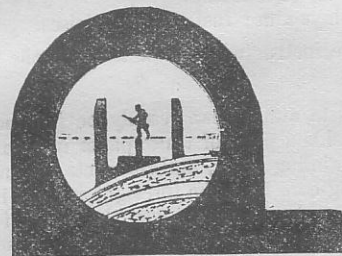


FIG. 1.

10. The method of aiming with the aperture pattern of "fixed sight" (Fig. 1) will be taught when the ordinary sight has been mastered. The system of instruction will be as described below:—

i. Illustration of a correct aim by diagram.

ii. Used up to 500 yards, for all targets, except point targets *e.g.*, loop-hole.

iii. Rules for aiming :—

- (a) Sights to be upright.
- (b) The eye to be placed as close to the aperture as possible.
- (c) The tip of the foresight in the centre of the aperture and directed at that part of the target on which it is desired the nucleus of the beaten zone shall fall.

iv. Method of instruction :—

- (a) Half-inch bull's eye target at 10 yards.
- (b) Rest for pupil's head (as in para. 6).
- (c) Instructor lays a correct aim.
- (d) Pupil views that aim.
- (e) Pupil lays aim ; instructor criticises.

Men should be instructed to look through the aperture and not at it.

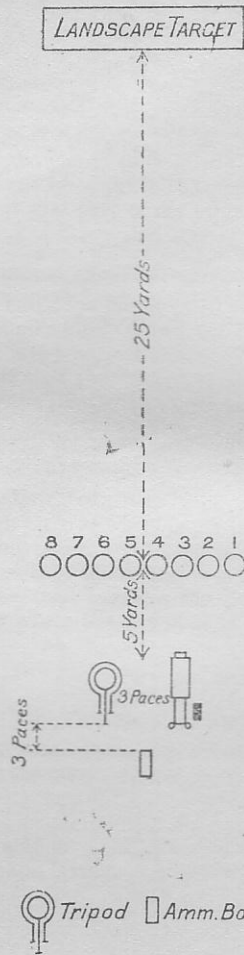
NOTE.—Faults in aiming can readily be pointed out as follows : The instructor holds a piece of white paper in front of the foresight, obliterating the aiming mark, and instructs the pupil to look along the sights, taking care that the foresight is kept in correct relation to the backsight ; he then removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

18. Elementary gun drill.

1. Elementary gun drill will consist of the following :—

- i. Mounting the gun.
- ii. Dismounting the gun.
- iii. Loading.
- iv. Unloading.
- v. Coming into action.
- vi. Sight setting and laying.

PLATE II.
[To face page 41.]
ELEMENTARY GUN DRILL—FALL IN.



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- vii. Coming out of action.
- viii. Traversing and searching.
- ix. Mounting and dismounting the gun in the lowest position.

In order that training may be progressive this sequence should be adhered to.

2.—Kit required for each gun team.

Gun, Mark IV tripod, belt box with belt and dummies, spare parts case complete, landscape target (if natural panorama is not available) and targets for Part I of the annual machine gun course.

3.—Laying out of kit.

- i. The gun and tripod will be placed in line on the ground, about 3 paces apart and about 30 yards from the landscape target.
- ii. Tripod on the left, legs to the rear.
- iii. Gun on the right, muzzle pointing to the front.
- iv. Spare parts case alongside and on the right of the gun.
- v. The belt box about 3 paces in rear of the interval between gun and tripod.

4.—“Fall In.”

On the command “Fall In” each detachment will fall in, in single rank, and stand at ease about 5 paces in front of the kit. (Plate II.)

5.—“Number.”

On the command “Number,” the detachment will spring to attention and number as in squad drill. The detachment will be cautioned that the No. 1 will repeat all subsequent orders, and that No. 2 will convey all signalled orders to No. 1.

6.—“Take post.”

On the command “Take post” the gun detachment will turn to the right and move at the double to positions as follows :—No. 1 will

pass behind the gun and tripod and fall in on the left of the tripod. No. 2 will fall in on the right of the gun. No. 3 will fall in on the left of the ammunition box. The remaining numbers will fall in about 5 paces in rear of No. 3, No. 4 being on the right. When the state of the ground permits all numbers will lie down. (Plate III.)

As soon as the No. 1 arrives at his position he will see that the elevating and cross-head joint pins are properly in position and turned down, and that both elevating screws are equally exposed, clamps tight, traversing clamp sufficiently tight to prevent the cross-head from swinging round when the tripod is being carried, direction and elevation dials secure.

No. 2 will at once attend to the following points :—Cork plug in, sliding shutter closed, front cover locked, "T" fixing pin screwed home and vertical, tangent sight set at 600, muzzle attachment correctly adjusted, and will sling the spare parts case across his right shoulder, first making certain that the contents are complete. (The inspection of the spare parts case is carried out twice only during drill—by the first No. 2 and by the last No. 2.) Care must be taken that the strap passes underneath the box respirator, if the latter is worn in the alert position.

No. 3 will examine the belt, see that the dummies are correctly placed in position and pointing the right way, and will then close the box. The catch of the ammunition box will be towards the front. He will then report "Ammunition correct" to No. 2, who will then report "Gun and ammunition correct" to No. 1, who in turn will report "All correct" (or otherwise) to the instructor.

NOTE.—In cavalry machine gun units the crosshead is carried permanently attached to the gun. The duties of Nos. 1 and 2 will be :—

As soon as the No. 1 arrives at his position he will see that the tripod legs are clamped tight, direction dial secure, and traversing clamp loosened to its fullest extent.

[To face page 42.]

PLATE III.
ELEMENTARY GUN DRILL—TAKE POST.

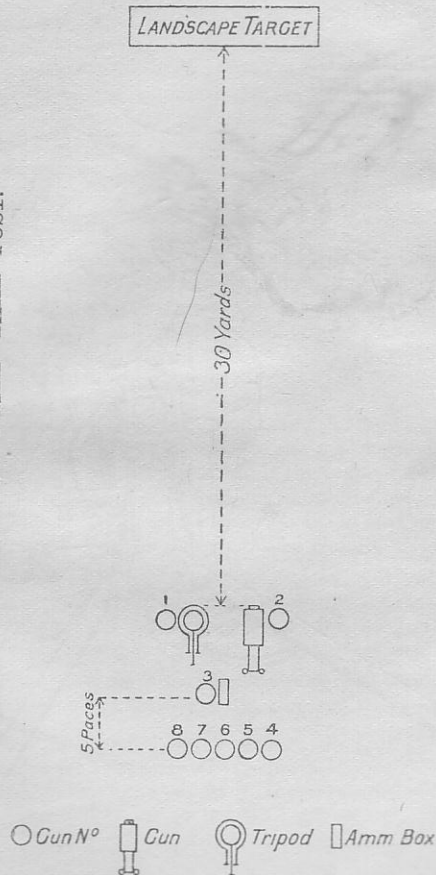
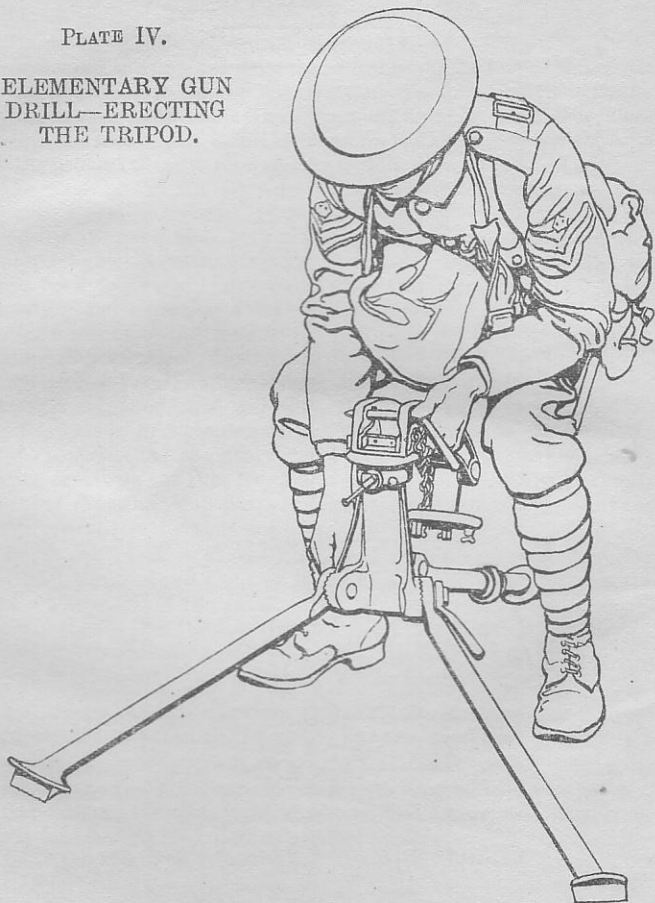


PLATE IV.
ELEMENTARY GUN
DRILL—ERECTING
THE TRIPOD.



No. 2 will at once attend to the following points :—Cork plug in, sliding shutter closed, elevating gear closed up, front cover locked, T fixing pin screwed home and vertical, tangent sight set at 600, muzzle attachment correctly adjusted, crosshead and elevating joint pins are properly in position and turned down, and will sling the spare parts case across his right shoulder, first making certain that the contents are complete.

7.—“ Mount gun.”

NOTE.—The instructor will now bring the detachment to the left of the position where the gun is to be mounted, so that they may see all movements clearly and listen to explanations. He will then act as No. 1 himself, giving and repeating the order “ Mount gun,” and will point out a position, which will be about 25 yards from the target, where the gun is to be mounted.

(a) *To erect the tripod.*—On the command “ Mount gun,” No. 1 picks up the tripod, doubles forward to the position indicated and places it in position. Whilst adjusting it the following points must be attended to : The cross-head bracket should be held by the left hand, close to the socket, the left fore-arm being supported by the left thigh, and both the jamming handles should, if possible, be manipulated with the right hand. (Plate IV.)

When the tripod is mounted the socket must be upright, the clamps tight, the tripod a convenient height for the firer when in a sitting position, and the rear leg in line with the target. No. 1 will sit down behind it and remove the elevating and cross-head joint pins whilst doing so.

(b) *To dismount the tripod.*—No. 1 springs up and then replaces both pins, taking care that they are properly in and turned down, loosens the jamming handles, folds the legs and clamps them

together again. He will then stand to "Attention" on the left of the tripod (or lie down).

NOTE.—Before dealing with the action of No. 2 all the members of the detachment should be practised in erecting and dismounting the tripod. When they have made reasonable progress with the tripod the instructor will then continue the instruction in "Mount gun." He will order one of the detachment to erect the tripod and will then himself act as No. 2.

(c) *To mount the gun.*—No. 2 picks up the gun, taking care not to dig the muzzle attachment into the ground whilst doing so, and opens the sliding shutter. Then, holding the right traversing handle with the left hand and carrying the barrel casing under the right arm, he doubles forward to the tripod, arriving about the same time that No. 1 is removing the elevating and cross-head joint pins. He then kneels on his left knee, places the gun on the tripod, supporting the barrel casing with the right thigh, and with his right hand he drives in the cross-head joint pin, handle upwards, and when it is home he turns the handle down. He retains his hold with his left hand on the right traversing handle until the pin is home and then releases hold. (Plate V.) (No. 1 has meanwhile grasped the left traversing handle with his left hand.) If the condenser is being used, No. 2 pulls out the cork plug. Meanwhile, No. 1 similarly puts in the elevating joint pin and turns it down.

No. 2 then lies down on the right of the gun, places the belt box in position in line with the feed block, and sees that the strap on the box is clear of the lid, or, if a metal box is used, that the quick release strap is disengaged.

After putting in the elevating joint pin, No. 1 will at once level the gun, test the traversing clamp to see that it is "sticky," and then sit with elbows resting inside the thighs and holding the traversing handles correctly. Eyes must be directed towards the target and not at his hands or gun.

[To face page 44.]

PLATE V.,

ELEMENTARY GUN DRILL—MOUNTING THE GUN.



NOTE.—In cavalry machine gun units the above drill is carried out as follows:—

(i.) *To erect the tripod.*—On the command "Mount gun," the No. 1 will erect the tripod by loosening the clamps of the two front legs, holding the socket with the left hand and the rear leg with the right hand.

When the legs are in position it will be adjusted with the socket upright by resting the left forearm on the left thigh, and manipulating both the jamming handles with the right hand.

When the tripod is mounted the No. 1 will sit down behind it.

(ii.) *To dismount the tripod.*—No. 1 will loosen the jamming handles of the two front legs of tripod, fold up the legs, tighten the jamming handles and lie down.

(iii.) *To mount the gun.*—No. 2 picks up the gun, then holding the right traversing handle with the left hand and carrying the barrel casing under the right arm he will place the pivot into the socket and lie down.

He then clamps the traversing clamp. Meanwhile, No. 1 will have levelled the gun and opened the sliding shutter.

No. 2 places the belt box in position in line with the feed block and will see that the strap on the box is clear of the lid.

The instructor will then act as No. 3.

No. 3 will double forward with the ammunition box and place it conveniently for No. 2—i.e., the catch (or quick release strap) towards the gun and the box placed in such a position that No. 2 is not likely to knock it over as he lies down. The ammunition box must be at hand directly No. 2 is ready for it.

No. 3 then doubles away, taking care not to take up a position directly behind the gun. If cover is convenient he should take advantage of it.

When the gun is mounted and the Nos. 1, 2 and 3 are in position, the following points should be criticised by the instructor:—

- i. Actions of No. 1, 2 and 3 until the gun is mounted.
- ii. Rear leg of the tripod in line with the target.
- iii. Shoes, not legs, of the tripod on the ground.
- iv. Jamming handles tight.
- v. Socket upright.
- vi. Traversing clamp sticky.

NOTE.—This must be tested by the instructor in the same way that the No. 1 tests it—*i.e.*, by tapping the traversing handle.

- vii. Pins properly in and turned down.
- viii. Elevating screws equally exposed.
- ix. Elevation dial secure.
- x. Tripod a suitable height for the firer.
- xi. Gun level and pointing towards the "front."
- xii. Cork plug out (if the condenser is to be used).
- xiii. Front cover locked.
- xiv. Sliding shutter open.
- xv. Tangent sight slide at 600 yards.
- xvi. No. 1 sitting and holding the gun correctly.
- xvii. No. 2 lying down, with his head below the level of the gun, spare parts case slung across his shoulder, with strap underneath the box respirator if worn in the alert position.
- xviii. Belt box in correct position, with the strap clear of the lid; or, if a metal box is used, with the quick-release strap disengaged.
- xix. No. 3 lying down in rear and to a flank.

NOTE.—When the instructor criticises, the faults each number has committed should be pointed out to the whole detachment.

8. "Dismount gun."

The instructor will demonstrate the duties of each number in turn.

On the command "Dismount gun," No. 1 will remove both pins, and as soon as No. 2 has removed the gun, he will stand up, replace both pins, loosen the jamming handles, fold up the legs and tighten the jamming handles, and, if necessary, align the crosshead arm over the rear leg.

No. 2 will push the belt box away from the tripod, lift the gun from the tripod, and replace the cork plug. Before placing the gun on the ground he will close the sliding shutter. He will finally re-set the sight at 600 yards if necessary.

NOTE.—In cavalry machine gun units the drill will be:—

On the command "Dismount Gun," No. 1 will close the sliding shutter and elevate the gun to its fullest extent. Meanwhile, No. 2 will have replaced the cork plug and unclamped the traversing clamp to its fullest extent. No. 2 will now lift the gun and crosshead clear of the mounting, place them on the ground, reset the sights at 600, if necessary, and lie down.

As soon as No. 2 has removed the gun No. 1 will loosen the jamming handles of the two front legs of tripod, fold up the legs, tighten the jamming handles and lie down.

9. "Load."

The instructor will act as the No. 1 and then as the No. 2, the detachment standing near the gun.

On the command "Load," No. 1 pulls the crank handle on to the roller with the right hand, and advances his left hand to the left of the feed block, ready to grip the belt.

No. 2 opens the belt box, holds the end of the belt (at the point where the brass tag joins the fabric) with his forefinger (right hand

recommended) along the tag, and pushes the tag through the feed block as far as possible.

NOTE.—With the metal belt boxes, both halves of the lid will be opened. One half may be closed later if necessary.

No. 1 grips the tag, and pulls the belt through the feed block as far as possible. He must pull the belt *slightly* to his left front when doing so. He then releases the crank handle, taking care not to allow his right hand to move forward with it. He again pulls the crank handle on to the roller, pulls the belt slightly to his left front, and releases the crank handle. Whilst pulling the crank handle on to the roller the belt will be held (but not pulled) with the left hand. He then resumes his holding on the gun.

NOTE.—The instructor should explain that the pulling of the belt slightly to the left front is only to avoid the natural tendency to pull it to the rear, *i.e.*, towards the No. 1, and that to pull the belt too much to the left front, or with much force, must be guarded against.

10. "Unload."

NOTE.—The instructor will perform the duties of No. 1 and then of No. 2, the detachment standing near the gun.

On the command "Unload," No. 1 will pull the crank handle on to the roller, and immediately allow it to fly forward again. Should the tangent sight be up, it will be lowered at the same time with the left hand. He will repeat this movement. He will then press the top and bottom pawls of the feed block with the right hand, the top pawls being pressed with the fingers, and the bottom pawls with the thumb, taking care to keep the hand clear of the entrance to the feed block. No. 2 will withdraw the belt and pack it carefully in the box. When the last round is clear of the feed block No. 1 will press the thumbpiece with the left hand. The wooden

box must be locked, but with the metal box the lids need only be closed, not locked.

NOTE.—All numbers should now be practised in loading and unloading until reasonable progress is made. Should any man exhibit a tendency to slur the loading motions, it may be advisable to make him load "by numbers," counting aloud whilst doing so.

11. "Action."

When the men have made sufficient progress in the foregoing lessons, they will be exercised in coming into "action." The instructor will define the "arc of fire" indicate the "front," and give the command or signal "Action." The gun will then be mounted with reference to the "front" and loaded, and when the No. 2 puts up his hand, the various points taught in previous lessons will be criticised.

12. To adjust the sights.

NOTE.—Before this lesson and the next are dealt with, instruction in aiming must have been given. (Sec. 17.)

On the range being given, No. 1 will raise the tangent sight (unless the range is 500 yards or under, when the fixed sight will be used), and adjust the slide to the range ordered.

13. To lay the gun.

On the target being indicated by the instructor, No. 1 will tap the gun over until the correct direction is obtained, and elevate or depress until the aim is correct. Should a large change in direction be necessary, No. 1 will order No. 2 to loosen the traversing clamp, and will swing the gun roughly on to the target, order No. 2 to tighten, and then lay accurately by taps. It is most important that whilst tapping the gun, or manipulating the elevating wheel, control of the gun should be maintained with the other hand.

As soon as the aim is correct and the correct holding taken, No. 1 will, by the word "Up," order No. 2 to put up his hand (Plate VI).

NOTE.—After the instructor has given a demonstration of how to lay the gun all the men will be exercised.

14. "Fire."

On the command or signal "Fire" being given, No. 2 will tap No. 1 lightly on the back and say "Fire," and No. 1 will instantly press the thumbpiece. He must press it in as far as possible.

The thumbpiece must be pressed in by a quick and even movement of the thumbs, and the eyes must be directed at the target. The tendency to look down at the thumbpiece must be checked.

15. "Cease fire."

On the command or signal "Cease fire" being given, No. 2 will tap No. 1 lightly on the back and say "Cease fire," and No. 1 will at once release the safety catch, and release the pressure on the thumbpiece. He should then check his aim, and correct it if necessary.

16. "Out of action."

The gun will be unloaded and dismounted on the spot.

On service No. 3 might not be required, Nos. 1 and 2 dealing with the belt box or boxes, as circumstances suggest.

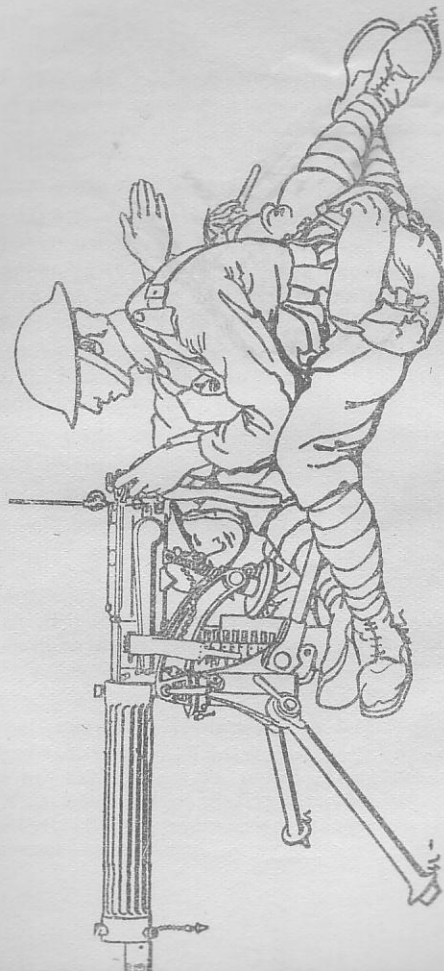
17. Traversing.

The gun will be mounted 25 yards from the target as used in the Annual Machine Gun Course, Part 1, before instruction begins; and the fact that the bull's-eyes are four inches apart must be pointed out to the men.

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PLATE VI.

ELEMENTARY GUN DRILL—NORMAL FIRING POSITION—SITTING.



The instructor will explain that the object of the exercise is to develop a consistent, automatic tap, and to teach the degree of tightness required in the traversing clamp, in order that the line of sight may be displaced fifteen minutes each time the gun is tapped.

The following points will then be explained :—

- i. A strong tap with a tight clamp is much preferable to a weak tap with a loose clamp.
- ii. When tapping with either hand, the gun must be held correctly with the other hand, and the safety catch kept raised.
- iii. Eyes must be directed at the target the whole time, and not at the rear end of the gun or along the sights, except momentarily for checking the aim.
- iv. If the gun moves too much or too little, the *traversing clamp* must be altered, *not* the tap.

Between each tap, the thumbpiece will be pressed for not less than two seconds, which is the time required to fire a group of 10 to 20 rounds.

The instructor will then show how he tests the traversing clamp, and give a demonstration of traversing. All numbers will then be exercised, tapping with the left as well as with the right hand; the tangent sight will be raised, but not used, during the exercise.

18. Searching.

The gun will be mounted 25 yards from the target, as used in the Annual Machine Gun Course, Part I.

The instructor will explain that the object of the exercise is to train men to turn the wheel so that the line of sight is displaced up, or down fifteen minutes for every turn, which will ensure the overlapping of beaten zones at all ranges.

The following points will then be explained :—

- i. The wheel will be manipulated with the right hand only.
- ii. The wheel must be grasped firmly and turned boldly—not hesitatingly.
- iii. Eyes must be directed at the target whilst the wheel is turned.

NOTE.—Whilst learning, the men should be allowed to look along the sights, so that they may realize how much the wheel ought to be moved.

Between each turn of the wheel, the thumbpiece will be pressed for not less than 2 seconds, which is the time required to fire a group of 10 to 20 rounds.

The instructor will give a demonstration, the men afterwards being exercised.

19. Oblique traversing.

The gun will be mounted 25 yards from the target, as used in the Annual Machine Gun Course, Part I.

The instructor will explain that the object of the exercise is to train men in combining traversing with the manipulation of the elevating wheel.

The following points will then be explained :—

- i. The correct sequence of action must be followed, *i.e.*, Fire, tap, elevate (or depress).
- ii. The tapping must be automatic as in ordinary traversing.
- iii. When elevating or depressing the gun, the sights must be used.

It is apparent that the greater the angle which the line to be traversed makes with the horizontal, the greater will be the turn necessary, to bring the sights on to the mark after traversing, and

vice versa. The turn in this case must not be confused with the fifteen minute turn in the previous lesson.

The instructor will give a demonstration, after which all the men will be exercised.

20. Swinging traverse.

The gun will be mounted 25 yards from the target, as used in the Annual Machine Gun Course, Part I.

The instructor will explain that this method of traversing is only employed against linear targets at very close ranges, when the normal method of traversing is likely to prove too slow.

The following points will then be explained :—

- i. A certain amount of "stickiness" is advisable from the point of view of control, the vibration of the gun rendering it easy to swing.
- ii. The gun must not be moved by a movement of the forearms only. The upper part of the body should be fairly rigid, and the gun should be moved by forcing the upper part of the body over to the opposite side to which it is desired to traverse.
- iii. The rate of movement should be such that the line of sight is moved about 1 yard in 2 seconds, when the target is 25 yards from the gun. The movement of the gun is almost imperceptible.
- iv. The thumbpiece should be pressed at the same time as the gun begins to move.

The instructor will give a demonstration, after which all the detachment will be exercised. The importance of the cross head being upright must be emphasized.

21. Mounting and dismounting the gun in the lowest position.

When the men have made sufficient progress in the previous lessons, they will be taught how to bring the gun into action with the tripod mounted in the lowest position.

The system of instruction will be as described in all the earlier lessons.

It will be explained that the low position **may** be necessary when only low cover, or none at all, is available.

The instruction will be divided into three stages.

1st Stage.

When, before beginning, the tripod is folded in the usual way, *i.e.*, the rear leg set at a suitable angle for the normal sitting position.

On the command "Mount gun," No. 1 will carry the tripod to the position indicated, place it on the ground, lie down on the left of it, and loosen all three jamming handles. He will then open the two short legs, raise the socket about 1 inch from the ground, and, keeping it upright, will clamp all three legs, clamping the rear one first. He will remove the elevating and cross-head joint pins.

No. 2 will open the sliding shutter, carry the gun to the position in the usual way, but just before lying down, will place the right arm under, instead of over, the barrel casing. He will then lie down and, assisted by No. 1, will place the gun on the tripod. (Plate VII.)

No. 1 will put in the cross-head joint pin. No. 2 will put in the elevating joint pin, and pull out the cork plug. No. 3 will bring up the belt box in the usual way.

When the gun is mounted, No. 1 will lie with both legs on the left of the tripod, right leg crossed over left, his back being supported by the right thigh of No. 2, and his neck being supported by the left

[To face page 54.]

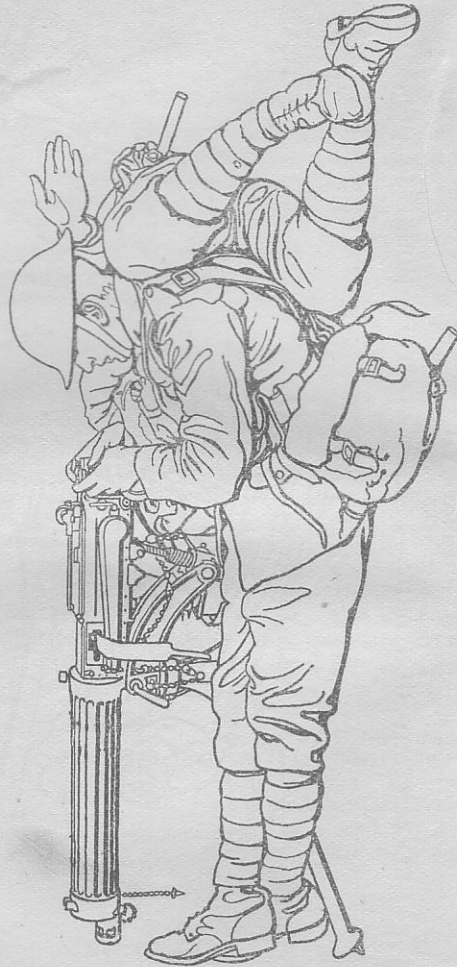
PLATE VII.

ELEMENTARY GUN DRILL—LOWEST POSITION—MOUNTING GUN.



PLATE VIII.

ELEMENTARY GUN DRILL—LOWEST POSITION—NORMAL FIRING POSITION.



knee of No. 2. (Plate VIII.) The gun will be laid with the aperture sight when "in action" in this position.

When the gun is mounted, the usual points will be criticised, and, in addition, note should be taken that the shoes of the tripod and not the tubular portions of the legs are resting on the ground, and that the jamming handle of the rear leg does not interfere with the elevating wheel.

The gun will be dismounted in the usual way, except that all movements, prior to carrying the gun and tripod to the original position, will be carried out in the prone position.

2nd Stage.

When, before beginning, the rear leg of the tripod is set and clamped at an angle suitable for the lowest position.

The instruction will follow the same lines as in the first stage. It will not be necessary to loosen the jamming handle of the rear leg on reaching the position.

3rd Stage.

When, before beginning, the rear leg of the tripod is set at an angle suitable for the prone position, and when, in addition, the two front legs, instead of being folded alongside the rear one, are swung forward and upward, pointing in the air.

The instruction will follow the same lines as in the second stage.

19. Tests of elementary training.

1. The following tests of elementary training have been devised to assist officers in testing the efficiency of their men in elementary training, and also to ensure that no detail of such training is overlooked. It is important that these tests should not be considered solely as competitions against time, for although quickness is necessary, accuracy is the first essential. No man should, therefore,

be passed as efficient unless all the points are properly fulfilled, even though he may complete them in the standard time. Men who, whilst passing the test for accuracy, slightly exceed the standard time, should be tested again before being put back for further instruction.

The nature of tests vii, viii and ix renders it inadvisable to lay down a standard time.

2. The tests must be carried out in strict accordance with the detailed instructions given, for unless the smallest details are insisted upon, the time limit will not be applicable. In carrying out these tests, time can be saved if the first pair complete tests 1 to 5 consecutively; the remainder can be carried out as convenient.

3. The entire personnel of a machine gun platoon, including the drivers when possible, should qualify in these tests, acting both as No. 1 and No. 2. This is necessary, for on service any member of a platoon may be required to replace a casualty at a moment's notice. In all tests No. 1 will repeat all orders received. The No. 1 should not be failed when, owing to the fault of No. 2, the time limit is exceeded. He must be tested again with a fresh No. 2.

4. No man will fire the Machine Gun Course until he has correctly passed these tests of elementary training. A record of these tests will be kept by each section commander and produced for inspection by the platoon commander as required.

i. To erect the tripod and mount the gun on the command "Mount gun."

Nos. 1, 2 and 3 will take post, lying down if the ground permits. The position where the gun is to be mounted to be not more than 5 yards away.

Points to be observed.—All the points given in Sec. 18, 7.

Standard time: 20 seconds.

ii. To load the gun on the command "Load."

Belt with a few dummy rounds at the end, properly packed in the box, which will be closed and fastened.

Points to be observed.—The gun to be correctly loaded; all loading motions to be quite distinct and correct, and to be carried out without any slurring.

Standard time: 5 seconds.

iii. To unload the gun on the command "Unload."

Points to be observed.—Gun unloaded, tangent sight lowered, unloading motions to be quite distinct, belt withdrawn and re-packed carefully in the box with lid closed and fastened; lock spring released.

Standard time: 5 seconds.

iv. To dismount the gun on the command "Dismount gun."

The gun will be dismounted on the spot.

Points to be observed.—All the points as when "All correct" is reported before mounting gun.

Standard time: 15 seconds.

v. To bring the gun into action on the command "Action."

This test combines (i) and (ii). It should therefore not be applied until proficiency has been attained in each of those tests.

Points to be observed.—All points as laid down for tests (i) and (ii) When No. 1 is ready to receive fire orders No. 2 will hold up his hand.

Standard time: 25 seconds. The time will be taken from the command "Action" until No. 2 raises his hand, indicating that the gun is loaded.

vi. To adjust the sights and lay the gun on the command
“(Range)—(Target).”

Gun loaded and ready to be laid. Three service targets will first be pointed out, but the No. 1 being tested will not know which is to be given. Any range may be ordered.

Points to be observed.—That the slide is adjusted and the gun laid with absolute accuracy.

Standard time: 12 seconds.

The time will be taken from the range being ordered until No. 2 holds up his hand, indicating that No. 1 is ready to open fire.

vii. Horizontal traversing. On the command “Fire,” e.g.,
“450—Horizontal row—From left bulls-eye—To ninth bulls-eye from left—Traversing—Fire.”

The target will be as for the Machine Gun Course, Part 1, placed at 25 yards from the gun. The gun will be laid on any bulls-eye that may be ordered. The tangent sight will be raised, but the firer must keep his eyes directed at the target during the traverse. The tests will comprise traversing from RIGHT to LEFT, as well as from LEFT to RIGHT. When the gun is laid, the aim should be checked by the officer conducting the test. On the command “Fire,” No. 1 will fire a group at the bullseye named, then traverse, so that the next group will be fired at the next bullseye and so on. The test will not be completed until the space between nine bullseyes has been traversed. In order to ensure that the traversing is satisfactory throughout, the order to cease fire will be given at least once during the traverse, but not before five groups have been fired, and the laying will be checked; this will be repeated when the limit of the traverse is reached.

Points to be observed.—That No. 1 tested his clamp before beginning the test; the object is to test if No. 1 has acquired the correct

automatic tap. Tapping backwards to correct errors will not be allowed. By counting the number of taps, the correct point of aim can be calculated.

viii. Searching. On the command “Fire,” e.g., “450—Right vertical row—From bottom bulls-eye—To top bulls-eye—Searching—Fire.”

The target will be as for the Machine Gun Course, Part 1, placed at 25 yards from the gun.

The procedure will be as for (vii) “Searching” being substituted for “Traversing.” The tests will comprise searching up and searching down.

Points to be observed.—The object is to test if No. 1 has acquired the correct automatic turn of the wheel. Turning the wheel backwards, to correct errors, will not be allowed. By counting the number of turns, the correct point of aim can be calculated as in (vii).

ix. Oblique traversing. On the command “Fire,” e.g.,
“450—Oblique row—Left bulls-eye—To fifth bulls-eye from left—Traversing—Fire.”

The target will be as for the Machine Gun Course, Part I, placed at 25 yards from the gun.

The procedure will be as for (vii) but in this test manipulation of the elevating wheel is included and the firer is allowed to look along his sights. The tests will comprise traversing from RIGHT to LEFT, as well as from LEFT to RIGHT.

Points to be observed.—As in test (vii.).

x. Immediate action.

In this test the man will be required to rectify correctly each of four different stoppages within a certain time. The officer super-

intending the test must ensure that the immediate action is correctly performed without any unnecessary delay.

A target should be indicated to the whole squad previous to the test. The crank handle should be covered with a cloth to conceal its position. On the removal of the cloth for covering the crank handle, the No. 1 will perform the immediate action.

Time will be taken from the moment the cloth is removed to the moment that the thumbpiece is pressed for re-opening fire. The immediate action must be correctly performed and the gun accurately relaid. The order in which stoppages are set up should be varied.

xi. Belt filling.

A heap of 25 rounds of ball ammunition will be placed beside a man, and these will be inserted in a belt.

Standard time—1 minute.

Points to be observed.—Rounds to be placed in a heap and not arranged. Inspection of the belt on completion will show if it has been filled correctly.

20. Advanced gun drill.

1. Advanced gun drill consists of drill over rough ground. Before this drill is carried out, a demonstration should be given in the use of cover from view, both natural and artificial, followed by practice in concealing gun positions.

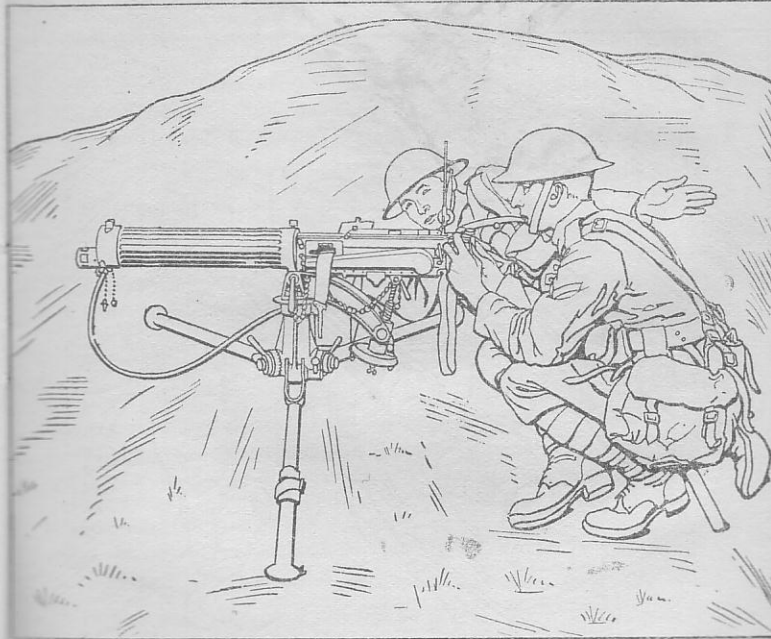
2. The object of this drill is to train the detachment in bringing the gun into action on rough ground. Practice will be given in mounting the gun on a steep slope, firing in any of the following directions :—

- i. To the front or rear.
- ii. To the right or left.
- iii. Up hill.
- iv. Down hill.

[To face page 60.]

PLATE IX.

ADVANCED GUN DRILL—GUN FIRING ALONG A STEEP SLOPE.



[To face page 61.

PLATE X.

ADVANCED GUN DRILL—GUN FIRING DOWN A STEEP SLOPE.



The drill should be taught individually by the instructor. The kit required is the same as for elementary gun drill, except that a landscape target is not required.

The instruction will be divided into two stages as follows :—

3. 1st Stage.

In this stage no targets are indicated, and the use of cover is not practised.

The instructor will show how the tripod is erected for all kinds of slopes and he will point out that :—

- i. The rear leg must always point downwards if the slope is very steep.
- ii. The socket must be upright.
- iii. Only the shoes of the tripod must touch the ground.

Each member of the detachment will then be exercised in erecting the tripod on a different position.

The instructor will then demonstrate the duties of No. 2 by mounting the gun on the tripod so as to fire in the required direction. He will also demonstrate the use of the belt box carrier, and other means of placing the belt box so as to ensure a correct feed.

Each member of the detachment will then be exercised in mounting the gun on the tripod to fire in different directions. (Plates IX and X.)

NOTE.—It is often more convenient after the tripod has been erected, but before the crosshead is swung round in the direction of the target, to have the gun mounted, and *then* swung round. By doing this, the task of No. 2 is easier than when the gun is mounted *after* the crosshead has been turned.

4. 2nd Stage.

In this stage an arc of fire will be given, the front indicated, and full use made of cover. No attempt should be made to introduce tactical lessons.

Nos. 1, 2, 3 and 4, with the gun, tripod, &c., will be in a position of readiness, not more than 10 yards from the selected gun position. The remaining numbers will be sent out as observers in the direction of the front and will criticise the movements of Nos. 1 and 2 as regards exposure when coming into action.

The instructor will mark a gun position, give the arc of fire, indicate the front, and then order "Action."

5. The following points should be criticised after No. 2 has raised his hand to indicate that the gun is in action:—

- i. Whether there was any unnecessary exposure whilst the gun was being brought into action.
- ii. Whether the gun is properly in action, and all the details of elementary training have been observed.
- iii. Whether the fire would clear any existing obstruction.
- iv. The correct erection of the tripod, with the rear leg down hill if necessary.
- v. Whether the tripod had to be altered after the gun was mounted.
- vi. The positions adopted by Nos. 1 and 2 as regards exposure and comfort.
- vii. The position of the belt box to ensure correct feed.
- viii. The position of No. 3 (minimum exposure, within view of the gun, and with ease of ammunition supply).
- ix. The position of No. 4.

When the men have made sufficient progress in the above, they should be practised in arranging and clamping, under cover, the position of all three legs (before mounting), so that the socket will be upright when the tripod is mounted on the position indicated.

21. Elementary section drill.

1. Elementary section drill consists of:—

- i. Section drill.
- ii. Limber drill (*see* Chap. IV).
- iii. Pack saddlery drill (*see* Chap. V).

Instructions in machine gun signals (Sec. 14) will be given before elementary section drill is carried out, and these signals should henceforth be used whenever possible.

Elementary section drill is carried out with four guns, *i.e.*, the section. An officer will control the drill, and a N.C.O. will supervise each gun detachment. The N.C.O. will take times and carefully note the performance of each movement; he will not assist the gun detachment, not give any instructions unless so ordered. When the state of the ground permits, all numbers should lie down, Nos. 3 and 4 forming a short chain of supply, and the remainder continuing the chain or representing reserves to replace casualties.

2. The purpose of elementary section drill is to increase proficiency in advanced gun drill, to accustom the various numbers to work as a section, and to provide practical instruction in the following subjects:—

- i. The delivery and execution of fire orders. This opportunity should be taken of practising officers and non-commissioned officers in fire control.
- ii. Immediate action.
- iii. The replacement of casualties and breakages.
- iv. The supply of ammunition, oil, and water.
- v. The various drill movements for carrying out indirect fire.
- vi. Limber drill and pack saddlery drill.

Section drill (Stages 1 to 5).

3. In order that a section may work in the field with efficiency, the methods of fire must be learnt as a drill. This will enable the

personnel in action to reproduce automatically the movements learnt in practice, with such modifications as the conditions of battle may impose.

Kit required for each gun detachment.

Gun with the barrel casing filled, tripod, two belt boxes and belts with dummies, spare parts box complete, condenser tube* fitted to gun, condenser bag half-filled with water.

4. Section gun drill will be taught in seven stages.

i. *First stage.*

The detachments will be exercised in all the movements of elementary drill up to and including "Action" and "Out of action," in both the normal and lowest positions. Fire orders should be simple, and alterations in sighting elevation and targets should be practised.

ii. *Second stage.*

In addition to the points mentioned in the first stage, the fire orders should include the use of traversing, searching and combined sights (Sec. 57). Also the fitting of the condenser tube and bag.

iii. *Third stage.*

In this stage service targets in the open country will be used.

In addition to the points mentioned in the previous stages practice should be given in :—

Immediate action.

Replacing casualties and breakages.

Ammunition, oil, and water supply.

* NOTE.—On all occasions during training, except when firing, a dummy condenser tube should be used to prevent the metallic tube from being damaged. The dummy tube can be made by attaching a union joint to a 6-feet length of one and a-half inch rope.

iv. *Fourth stage.*

As for previous stages, but introducing the issue, carrying out and passing of fire orders.

v. *Fifth stage.*

As for previous stages, but introducing safety methods both lateral and vertical for direct overhead fire, viz., graticule and tangent sight methods.

5. *Sixth stage.*

As for the first three stages, but introducing the laying of guns on parallel lines preparatory to using indirect fire.

Kit required for each gun detachment.

Gun and tripod.

Bar foresight.

Belt boxes (4), belts, and dummies.

Condenser tube and bag.

Clinometer.

Cleaning rod.

Spare barrel and spare parts case.

Two posts—the "zero post" and the "target post."

Guns and tripods will be laid out as in elementary gun drill.

i. "Fall in."

Detachments will fall in in line as in elementary gun drill, one commanders on the right of Nos. 1.

The section commander will indicate the reference object (if one is being employed).

ii. "Number."

As in elementary gun drill.

iii. "Take post."

As in elementary gun drill. No. 3 has with him a condenser bag, four belt boxes, and the posts. No. 4 has the spare barrel. The gun commander takes post on the left of No. 1, and has the cleaning rod, clinometer, and bar foresight.

iv. "Tell off by guns."

The gun commanders number off from the right: "No. 1 gun," &c.

v. "Prepare for action."

No. 1 examines the tripod, and No. 2 prepares the gun (condenser tube fixed) for action. No. 3 inspects the ammunition. Nos. 5 to 8 are spare men, and remain under cover.

vi. The section must now be laid on parallel zero lines. All methods of doing this should be practised. When a reference object is used the drill will be as follows:—

(a) "*Flank guns—Mount gun.*"—The flank guns are mounted and laid on each other. No. 2 of each gun zeroises the direction dial and signals with his hand to the other No. 2 when this is done. Both guns now lay on the reference object, and the angle swung through is noted. These angles are passed along to the section commander, who then calculates the distribution angle to obtain parallel lines.

(b) "*Remainder—Mount gun.*"—The remaining guns are mounted and laid on the reference object. No. 3 of each gun brings up two belt boxes and the condenser bag. Nos. 2 and 3 ensure the firm bedding of the tripod legs. No. 2 places the condenser tube inside the bag. The gun commander fits the bar foresight on to the gun.

(c) The angle of distribution from the reference object necessary to bring all guns on to parallel lines, followed by the angle of switch from the reference object necessary to bring all guns on to parallel zero lines will now be passed to each gun commander, either verbally or in writing.

The angle of distribution will be laid off by means of the bar foresight and the angle of switch by the direction dial.

(d) When the gun has been laid on its parallel zero line, the gun commander will adjust the bar foresight to zero. No. 3 will then drive in the zero post at such a distance from the gun as will ensure that the post is not struck by bullets when fire is opened. In this he will be directed by No. 1, who will adjust the tangent sight slide to bring the line of sight on to the post.

The zero post will not be moved once the gun has been laid on its parallel zero line.

6. Seventh stage.

As for sixth stage, but introducing the issue, carrying out and passing of fire orders for indirect fire. The gun commander kneels down with the cleaning rod and clinometer on the left of No. 1.

The angle of switch necessary to engage the first target will be given verbally or in writing. No. 3 will then drive in the target post at such a distance from the gun as will ensure that the post is not struck by bullets when fire is opened.

In many cases the zero line may be made to coincide with the line of fire to the first target. In such cases no target post will be required by day.

Orders for distribution (if necessary) will then be given.

Whenever possible these and subsequent orders for changes of direction and elevation should be given in writing in the form of a gun chart.

When the angle of deviation from the zero line does not exceed 7 degrees it can be laid off from the zero post by means of the bar foresight, in which case there will be no need to place out the target post by day.

The gun commander will place the elevation on the gun by means of the clinometer.

When direction and elevation have been placed on the gun, the gun commander will report "No. 1 gun ready," &c.

i. "Load."

As in elementary gun drill.

ii. "Traverse."

Will be 2 degrees, *i.e.*, 1 degree right and 1 degree left, unless otherwise ordered.

iii. Rate of fire.

Slow, medium, or rapid.

iv. "Fire."

Bursts of fire should not be less than 50 rounds. No. 1 re-lays between bursts, and traverses between bursts. *Accuracy in re-laying must always be insisted upon.*

v. "Cease fire."

Procedure after every 500 rounds, when the tactical situation allows:—

No. 1 unloads and clears gun.

No. 2 cleans the barrel and replenishes the water in the barrel casing, if necessary.

No. 3 brings up ammunition.

No. 1 oils up, reloads, and lays for direction.

Gun commander checks elevation.

No. 2 signals "Ready to fire."

In any case the above procedure must be carried out after every 1,000 rounds fired.

vi. "Unload."

As in elementary gun drill. The gun commanders report "No. 1 gun clear," "No. 2 gun clear," and so on.

vii. "Out of action."

The guns will be dismounted at the firing point.

viii. Sections should be practised in coming into action in different positions, obtaining parallel lines by different methods, and firing by charts. In the latter case, verbal orders should be dispensed with as far as possible.

In the final stages of training, section commanders should be practised in applying the fire of their sections to any target with rapidity and accuracy. Throughout the drill, gun numbers must be changed round frequently.

7.—Examples of verbal orders.

Either of the flank guns may be the directing gun. In the following examples the left gun is taken as the directing gun.

(a) DISTRIBUTION.

i. To obtain parallel lines.

"Distribute 20 minutes."—This is the angle obtained by the section commander in para. 5, vi. (c). The angle 20 minutes has been used simply for the purpose of illustration.

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The same applies to all other angles. This order will be passed down as follows:—

The gun commander of No. 4 gun repeats the order and the laying of No. 4 gun is not altered.

The gun commander of No. 3 gun repeats "20 minutes right—Distribute 20 minutes," and No. 3 gun is laid off 20 minutes to the right of the reference object by means of the bar foresight.

The gun commander of No. 2 gun repeats "40 minutes right—Distribute 20 minutes," and the gun is laid off 40 minutes to the right of the reference object by means of the bar foresight.

The procedure for the other gun is similar to the above.

The guns are now laid on parallel lines and can be swung on to their zero lines as follows:—

"All guns—Degrees right (or left)."

Each gun commander repeats the order and the gun is laid off the given angle from the reference object on the direction dial.

The guns are now laid on parallel zero lines.

ii. To engage a target.

"All guns on zero lines."

The gun commander repeats the order. No. 1 lays on the zero post.

"All guns—Degrees right (or left)."

The gun commander repeats the order. No. 1 lays off the given angle on the direction dial. No. 3 paces out 10 yards from the cross-head and, directed by No. 1, drives in the target post.

"Distribute 20 minutes."

The procedure is the same as in (i) except that the target post is here used instead of the reference object.

(b) ELEVATION.

i. "Elevation 3 degrees."

Each gun commander repeats the order and lays the gun to that elevation with the clinometer. No. 1 adjusts the tangent sight slide to bring the line of sight on the target post and notes the reading on the sight.

ii. "Elevation 4 degrees—Add 20 minutes."

The gun commander of No. 4 gun repeats the order and lays the gun to 4 degrees with the clinometer. No. 1 proceeds as in (i).

The gun commander of No. 3 gun repeats "Elevation 4 degrees 20 minutes—add 20 minutes," and lays the gun to 4 degrees 20 minutes with the clinometer. No. 1 proceeds as in (i).

The procedure for the other guns is similar to the above.

iii. "Elevation 5 degrees—less 10 minutes."

The gun commander of No. 4 gun repeats the order and lays the gun to 5 degrees with the clinometer. No. 1 proceeds as in (i).

The gun commander of No. 3 gun repeats "Elevation 4 degrees 50 minutes—Less 10 minutes," and lays the gun to 4 degrees 50 minutes with the clinometer. No. 1 proceeds as in (i).

The procedure for the other guns is similar to the above.

22. Advanced section drill.

1. Before this drill is carried out the following should have been given :—

- i. A short lecture on the characteristics of the machine gun.
- ii. A short lecture on reconnaissance, especially with reference to the selection of gun positions.

2. The object of advanced section drill is to practice the section in carrying out the various forms of drill already taught in elementary section drill, and in applying it to suit all forms of ground. All ranks must be exercised in their respective duties. For this purpose, all movements, dispositions, &c., must be made with reference to some tactical situation explained beforehand by the section commander. The situation must be such as will necessitate the employment of scouts and rangefinders in a realistic manner. Ranges will actually be taken. Ammunition supply will be carried out, empty boxes being passed back for refilling. The replacement of casualties and breakages will be practised but must not be carried to an extreme. The points to be attended to in elementary section drill must be carefully observed.

As proficiency increases, practice should be given in situations which require rapid action, such as changes of targets and of gun positions to meet surprise situations.

The drill should be carried out in stages or lessons as shown below.

3. First stage.

To give practice to gun numbers in the following :—

- i. Reconnaissance for gun positions.
- ii. The use of cover in :—
 - (a) The approach to the gun position (see Sec. 40, 3).
 - (b) The gun position itself (see Sec. 40, 3).

- iii. The method of approach to the gun position as regards the carrying of the gun, tripod, &c. Concealment will be considered of greater importance than rapidity within reasonable limits.

In this lesson limbers will not be used, but the section should be drawn up in a position of readiness at least 300 yards from the ground on which the guns will come into action. The ground selected should be suitable for inculcating the lessons to be learnt in the reconnaissance and selection of gun positions (see Sec. 41) and in the use of ground (see Sec. 40).

The frontage should be at least 200 yards wide, and should contain more than one possible position.

4. Second stage.

To teach the selection of gun positions with reference to :—

- i. Ability to fire within the arc of fire ordered.
- ii. Communication with observation post.
- iii. Provision of a chain of ammunition supply under cover.

5. Third stage.

As for first and second stages, but introducing action from limbers. This will entail attention to the following points :—

- i. Drill must not be divorced from tactics. After the gun position has been selected and the order has been given to bring up the guns, application of drill is required in getting the guns into action. The danger of the detachments bunching together when advancing from the limbers to the gun position must be avoided.
- ii. Broadly speaking, except in the case of a fleeting target, when it will be expedient to open fire at once with the first gun to get into action, a section commander will wait till all his guns (or at any rate three of them) are

ready to open fire before he gives the signal to do so. A systematic arrival of the various numbers at the gun position should be aimed at. Undue haste, which will only lead to confusion, should be avoided. Detachments must be well under control when going into action, and such control should be exercised by the N.C.O. at the limbers. There is need for quick action, but it must not be allowed to degenerate into a scurry and there should be no shouting.

- iii. Generally speaking, crawling should be confined to movement over the last few yards in approaching a position. When longer distances must be covered, in possible view of the enemy, it is better to make a bold dash right up to the gun position, simulating the movement of infantry as much as possible.

- iv. *Protection.*—The principle that every unit is responsible for its own protection must be impressed upon all ranks, and practice must be given in the methods of protection to be employed. The measures against surprise which have been taken when the guns are on the move must not be relaxed when the guns are in action. Protection of the flanks is of special importance, and steps must always be taken to watch any locality from which the gun position may be turned.

6. *Fourth stage.*

As for previous stages, but introducing changing from limbers to pack and coming into action from the latter.

NOTE.—The ground selected should, if possible, be such as to necessitate this change.

7. *Fifth stage.*

As for the third stage, but introducing a forward movement of the section, on limbers, to another position.

Use of limbers.—The fullest possible use should be made of limbers for the rapid conveyance of guns and men.

Where the line of approach is concealed from the enemy, limbers should be brought up as close as possible in the first instance. But as soon as the limbers have been unloaded they should be sent back to a suitable position far enough away to avoid shell-fire directed at the guns. On the other hand, if safe cover (such as a quarry or very steep slope) exists close behind the gun position the limbers may remain there.

In a situation where it is absolutely essential to get into action without a moment's delay, and where the nature of the ground permits of no alternative, limbers should be driven boldly up to the gun position, quickly unloaded, and as quickly driven away to suitable cover.

Limbers must not bunch together. They should be kept at least 40 yards apart whenever they are on ground which may be subjected to hostile fire. Touch must be kept between the limbers and the guns when the latter are in action.

8. *Sixth stage.*

As for the previous stages, but with the forward movement carried out on pack (see note to fourth stage).

9. *Seventh stage.*

As for fifth stage, but applied to suit indirect fire positions.

10. *Eighth stage.*

As for seventh stage, but introducing selection of gun positions by gun commanders to ensure clearance of the immediate obstruction in accordance with instructions received regarding lowest elevation to be used and limits of arc of fire.

11. After the section has attained proficiency in each of the above stages, it should be practised in carrying out elementary tactical exercises framed so as to bring out all the lessons to be learnt in several of the above stages, and carried out on different areas of ground.

It will be of great advantage if these exercises can be carried out in co-operation with infantry. Before each exercise is begun the section officer will explain its purpose and the principles that will be followed in carrying it out, and, on its conclusion, detailed criticism will be made.

In this way the rank and file should gradually be trained in elementary tactical principles, and their initiative encouraged and developed along sound lines. In these exercises, in addition to all the points mentioned previously, particular attention should be paid to:—

- i. Formations to be adopted in battle (*see* Infantry Training, Vol. I).
- ii. Inter-communication, both by signal and runner.

CHAPTER IV. LIMBER DRILL.

23. General instructions.

1. In packing limbers attention should be paid to the following considerations:—

- i. *Tactical*.—These will affect the distribution of the loads both as between each portion and as between the limbers themselves. In the system detailed below all equipment and supplies necessary for the guns being brought into action are carried in the fore portion of the gun limber and further supplies are carried in the hind portion. If the tactical situation demands rapid action a few gun numbers can ride in the fore portion, the hind portion being unhooked if desired.
- ii. *Balance of limbers*.—It is important, if galls on the animals are to be minimised, that the load in each portion of the limber should be well balanced. Also, the fore portion should carry a heavier load than the hind portion.
- iii. *Speed in coming into action*.—In order that the guns may come into and out of action as rapidly as possible it is necessary for all ranks to know exactly where every article is carried, and for the gun numbers to be well drilled in packing and unpacking the gun limbers. A uniform system should be adopted and in every section a N.C.O. should be detailed to supervise the packing of the limbers correctly.

2. In this chapter a drill for packing the gun limbers is given. The drill will be carried out at the double. The tailboard of the fore portion should never be lowered when the hind portion is attached and the animals are hooked in.

The pack saddlery will be carried on the off-side animals, with the exception of the hangers and racks (carried in the hind portion of the gun limber) and the water boxes (carried in the fore portion of the gun limber).

When the packs of the officers, warrant officers, N.C.Os. and men are carried on the limbers they should be distributed evenly between the limbers, the importance of balance being kept in mind.

24. Packing limbers.

1. The equipment, as shown in the load tables (gun limber), Sec. 26, will be dumped in rear of the limber.

"Fall in."—The sub-section (excluding drivers who will stand to their horses) will fall in immediately in rear of the limber, in two ranks.

"Number"—as in elementary gun drill.

2. "Pack limber."

i. Fore portion (Plates XI and XII).

On the command "Pack limber," the Nos. 1 and 2 double to the dump, take three belt boxes each and place six on each side of the limber, upright, the side of the box touching the side of the limber, arrowhead pointing inwards.

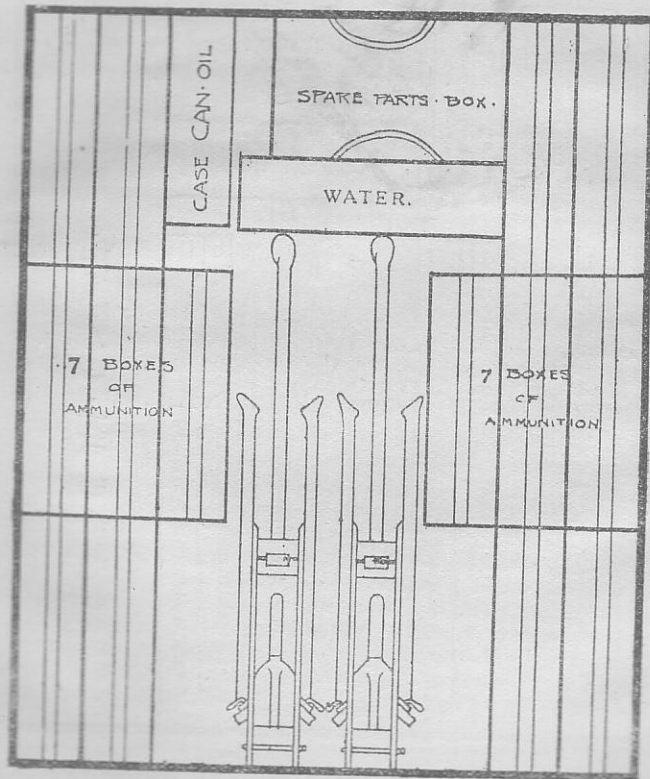
Immediately the belt boxes are in position the Nos. 3 and 4 place the gun chests on top, one on either side of the limber, hinges towards the sides of the limber.

The Nos. 1 will then follow with the Mark IV tripods, condensers and condenser tubes, placing the tripods in the centre of the limber,

[To face page 78.]

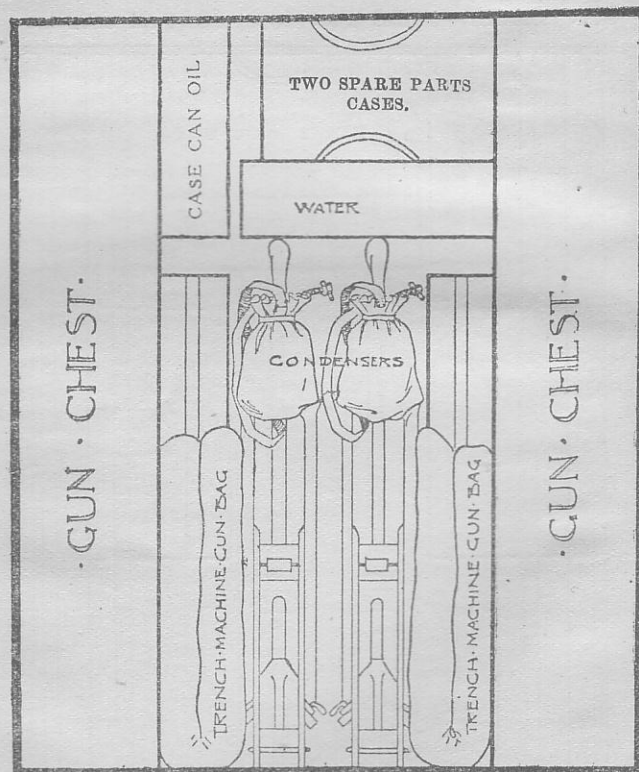
PLATE XI.

GUN LIMBER—FORE PORTION—BOTTOM LAYER.



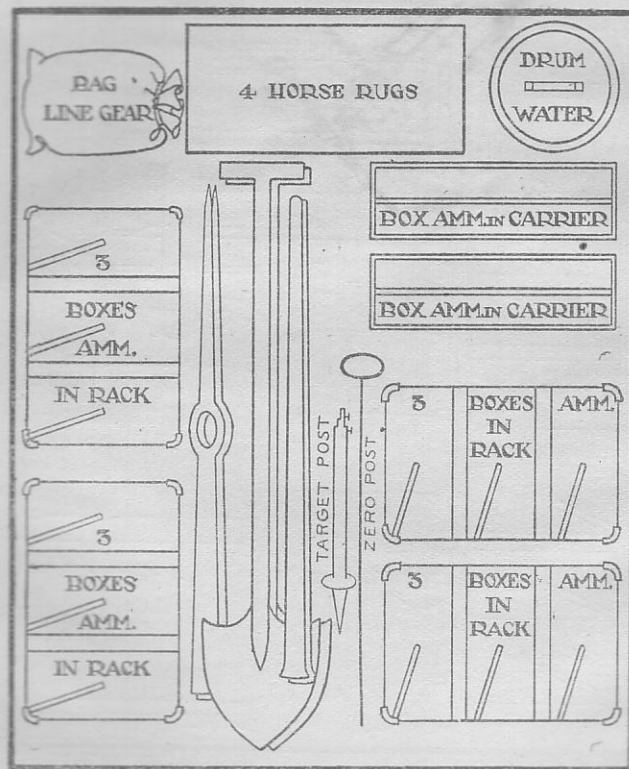
[To follow plate XI.

PLATE XII.
GUN LIMBER—FORE PORTION—TOP LAYER.



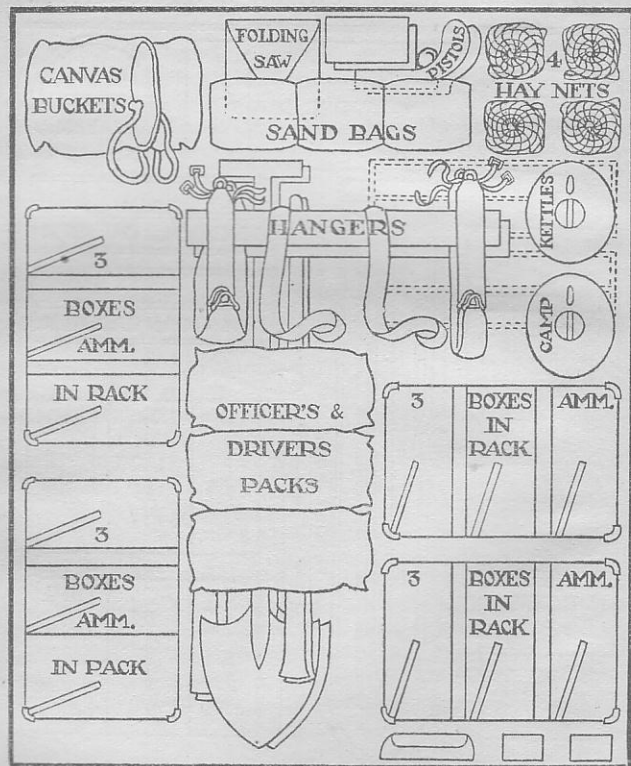
[To follow plate XII.

PLATE XIII.
GUN LIMBER—REAR PORTION—BOTTOM LAYER.



[To follow plate XIII.]

PLATE XIV.
GUN LIMBER—REAR PORTION—TOP LAYER.



SHOES VALISE NIGHT
FIRING LAMPS

cross-heads touching the tailboard and as close to each other as possible. The condenser bags and tubes will be placed on top of the legs of the tripods.

No. 2 of the right detachment will bring up the spare parts box and place it in the front end of the limber, slightly to the off side, hinges to the rear. At the same time No. 2 of the left detachment will bring up two belt boxes and place one on each side of the limber, upright, next to the middle belt box on the floor of the limber.

No. 3 of the right detachment packs the spare parts cases on top of the spare parts box. No. 3 of the left detachment packs the oil can cases in the space on the near side against the spare parts box.

No. 4 of the right detachment packs the water boxes upright, against the rear of the spare parts box. The other No. 4 packs the trench machine gun bags between the Mark IV tripods and gun chests, one on each side.

All Nos. 1 to 4 of each detachment place the cover on the limber, the right detachment on the off-side and the left detachment on the near-side.

ii. Rear portion (Plates XIII and XIV).

On the command "Pack limber," No. 5 of the right detachment places the water drum and hay nets in the front off corner, hay nets on top of the drum. The other No. 5 places the four horse rugs against the front end of the limber and touching the drum.

No. 6 of the right detachment brings up the signal pistols, folding saw, and bags line gear (filled with mallet, pegs, &c.), placing the bags line gear in the front near corner and the pistols, periscopes and folding saw on top of the four horse rugs. At the same time the other No. 6 will place one canvas rack (containing three belt boxes), lengthways, on the near side of the limber, touching the bag line gear, lids to be against the near side of the limber.

No. 7 of the right detachment will place the two metal carriers (each containing one belt box) upright, and as far forward as possible on the off side, touching the water drum and horse rugs. The other No. 7 will place one canvas rack on the near side, lengthways, in rear of the one already packed.

The Nos. 8 place two canvas racks as far forward as possible, the ends touching the off-side of the limber.

The Nos. 5 pack four camp kettles on top of the metal carriers.

No. 6 of the right detachment packs the night firing lamps in the "off" rear corner of the limber, and the zero posts and target posts alongside the canvas racks on the off-side. The other No. 6 packs the tools on the floor space, heads to the rear.

No. 7 of the right detachment places the horseshoe valise against the night firing lamps in the "off" rear corner of the limber. The other No. 7 packs the sandbags on top of the horse rugs, and two canvas buckets on top of the bag line gear.

No. 8 of the right detachment places the two hangers and the two web surcingle on top of the metal carriers and tools. The other No. 8 places the two drivers' packs in the centre.

All numbers 5 to 8 of each detachment place the cover on the limber, the right team on the off-side and the left team on the near-side.

25. *Action from limbers.*

1. "Prepare for Action."

On the command "Prepare for Action," Nos. 1 to 4 of each detachment double to the limber (the right detachment on the off-side, the left detachment on the near side) and remove the covers from the limber.

The Nos. 1 take the tripods and carry out their normal duties.

The Nos. 2 and 3 remove the guns from the chests.

The Nos. 3 take out the spare parts cases, and hang them over the shoulders of their Nos. 2, who then double out with the guns and condenser tubes to their Nos. 1.

The Nos. 3 each take two belt boxes, and carry out their normal duties.

The Nos. 4 half-fill the condenser bags from the water drum in the rear portion, double out, each with a condenser bag and one belt box, and lie down under cover.

The N.C.O. detailed then moves the limber to cover, the Nos. 5, 6, 7 and 8 accompanying him.

2. "Out of action."

On the command "Out of action," the N.C.O. moves the limber up to the most convenient position for the guns coming out of action, consistent with the safety of the animals.

The Nos. 3 and 4 take out the gun chests, repack the belt boxes, and tidy the limber.

The Nos. 4 take the condenser tubes off the guns as soon as the Nos. 2 arrive with them.

The Nos. 2 and 3 repack the guns in the chests, close the lids, replace the chests, and the Nos. 2 hand the spare parts cases to the Nos. 3 to repack in the limber.

The Nos. 1 repack the tripods, and the Nos. 4 repack the condenser bags and tubes.

All numbers 1 to 4 of each detachment replace the cover on the limber, the right detachment on the off-side and the left detachment on the near-side.

26. *Load tables.*

1. The following load tables should be considered as a guide only and not as definite instructions, owing to the necessity of adapting the load to suit local conditions. Modifications of these tables will be required on the introduction of stripless belts packed in special boxes.

2. Gun Limber—Fore Portion.

Articles.	No.	Approximate weight.
		lbs.
Bags, trench, machine gun	2	10
Belts, ammunition, in single boxes (filled)	14	294
Boxes, spare parts and tools (filled)	1	22
" water (filled)	2	38
Cans, lubricating, No. 9 (filled)... ..	4	6
" half-pint (filled)	4	4
Cases, cans, oil (also containing spare joint pins, crosshead two, and elevating, two)	2	6
Condensers, steam (bag and tube, with union joint)... ..	2	4
Guns, Vickers, complete filled with water, each with cork plug, muzzle protector, cleaning rod and spare barrel, in chests	2	160
Mountings, tripod, Mark IV., with dials	2	104
Rifles of two drivers, with covers	2	20
Load, fore portion ... ..	...	668

3. Gun Limber—Rear Portion.

Articles.	No.	Approximate weight.
		lbs.
Axes, pick, heads and helves	2	12
Bag, line gear (containing mallet, brushes, rubbers, &c.)	2	30
Bags, sand, common	30	12
Belts, ammunition, in single boxes (filled)	14	294
Buckets, water, G.S., canvas	2	1
Carriers, ammunition belt box	2	10
Drum, oil, containing spare supply of water (filled)... ..	1	37
Hangers, gun and tripod	2	17
Kettles, camp, oval, 12 quarts	4	36

3. Gun Limber—Rear Portion—continued.

Articles.	No.	Approximate weight.
		lbs.
Lamps, night firing	2	10
Nets, hay	4	2
Packs of section officer and two drivers	3	45
Pistols, signal, 1 in.	2	4
Posts, zero	2	5
Posts, target	2	8
Racks, boxes, ammunition in belt	4	24
Rugs, horse	4	40
Saws, folding, complete	1	2
Shovels, G.S.	2	7
Shoes, horse or mule, with nails, in valise	8	12
Load, rear portion ... ..	...	608
" fore portion ... ..	...	668
Total load... ..	...	1,276
Wagon, limbered, G.S., equipped ... ..	...	1,262
Total loaded gun limber ... ..	...	2,538

4. Ammunition Limber—Fore Portion.

Articles.	No.	Approximate weight.
		lbs.
Bar, supporting draught pole, No. 3 (spare)	1	10
Cartridges, S.A.A. ball	9,000	675
Cartridges, ball, pistol, Webley (reserve)	150	8
Machine, filling belt, in chest	1	42
Swingletree, No. 13 (spare)	1	7
Rifle of driver, with cover	1	10
Load, fore portion ... ..	...	752

5. Ammunition Limber—Rear Portion.

Articles.	No.	Approximate weight.
Axe, felling, curved helve	1	lbs. 4
Bag, line gear (containing mallet, brushes, rubbers, &c.) ...	1	12
Box, Barr and Stroud rangefinder	1	12
Buckets, water, G.S., canvas	2	1
Cartridges, S.A.A. ball	9,000	675
File, regular cut, 12 inch, with handle, middling ...	1	1
Hooks, bill	1	3
Knives, opening tins	2	1
Megaphone, 10 inch	1	1
Nets, hay	2	1
Pack of driver	1	15
Rugs, horse	3	30
Shoes, horse or mule, with nails, in valise	4	6
Stand, signalling, telescope	1	4
Load, rear portion ... ..	...	766
„ fore portion ... ..	...	752
Total load... ..	...	1,518
Wagon, limbered, G.S. equipped ... ..	...	1,262
Total loaded ammunition limber ... ..	...	2,780

CHAPTER V.

PACK SADDLERY DRILL.

MACHINE GUN PLATOONS WHOSE EQUIPMENT IS CARRIED IN LIMBERS.

27. General instructions.

1. Pack saddlery is used as a method of carriage by:—

- i. Machine gun troops (cavalry).
- ii. Machine gun platoons, whether their equipment is carried (a) entirely on pack, or (b) normally in limbers.

2. When it is found necessary to use pack animals instead of limbers, the two lead animals of the gun limbers will become pack animals, the near leader carrying the ammunition pack and the off-leader the gun and tripod pack.

Each gun detachment should be practised in the following drill, for which purpose the detachment will consist of Nos. 1 to 8, No. 8 acting as leader of one pack animal.

To prevent alarming the animals the drill will be carried out in quick time, not at the double.

NOTE.—For details of sets and description of gear see Handbook for the .303 in. Vickers Machine Gun, Sec. XVI. The hanger with two narrow slings, used in this drill for the gun, is officially known as the hanger, gun, sling; and the hanger, with one wide and one narrow sling, used for the tripod, is officially known as the hanger, tripod, sling.

28. Loading pack saddles from limbers.

1. "Fall in."

On the command "Fall in," the sub-section (excluding drivers who will remain mounted) will fall in immediately in rear of the limber, in two ranks.

2. "Number"—as in elementary drill.

3. "On pack saddles."

On the command "On pack saddles," No. 8 moves up and holds the leaders, and the brakesman, after applying the brake, moves up and holds the wheelers. The lead driver releases the neck straps and breast collar quick releases on the near side of each leader. The leaders are then walked forward clear of their harness. The lead driver then off-saddles the near leader. The driver of the wheelers takes off the pack saddle and two feeds from the off-wheeler, and puts the feeds in the rear-portion of the limber; with the assistance of the other driver he puts the saddle on the near-leader, adjusts the pack saddlery breast collar and breeching of the off-leader, and places all surplus harness in the fore portion of the limber.

At the same time Nos. 1, 2, 3 and 4 take off the cover of the front portion, and Nos. 5, 6 and 7 the cover of the rear portion of the limber, and all the gun team, employed as below, remove the necessary gear and equipment required for the packs, so that the drivers can place their harness in the limbers.

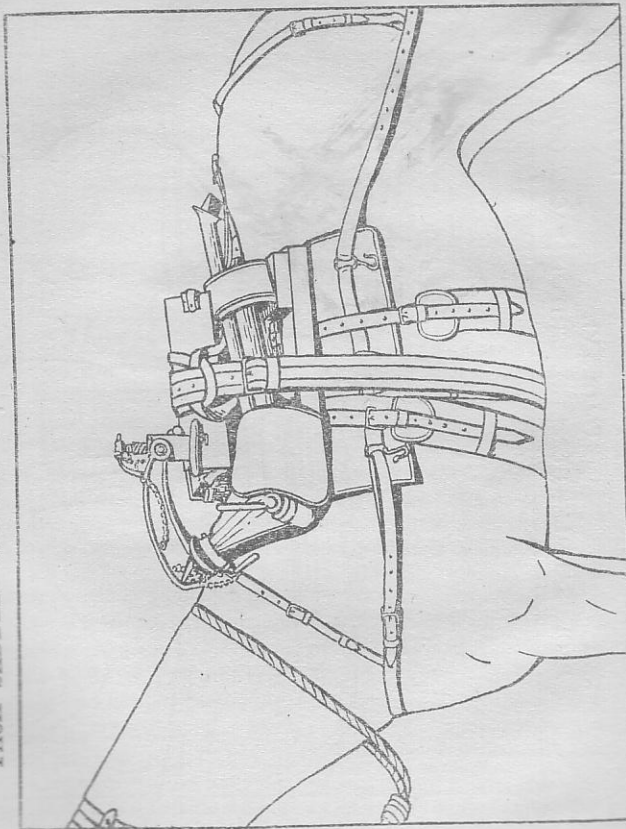
i. *Gun and tripod pack* (Plates XV and XVI). Numbers required—1, 2, 5 and 6.

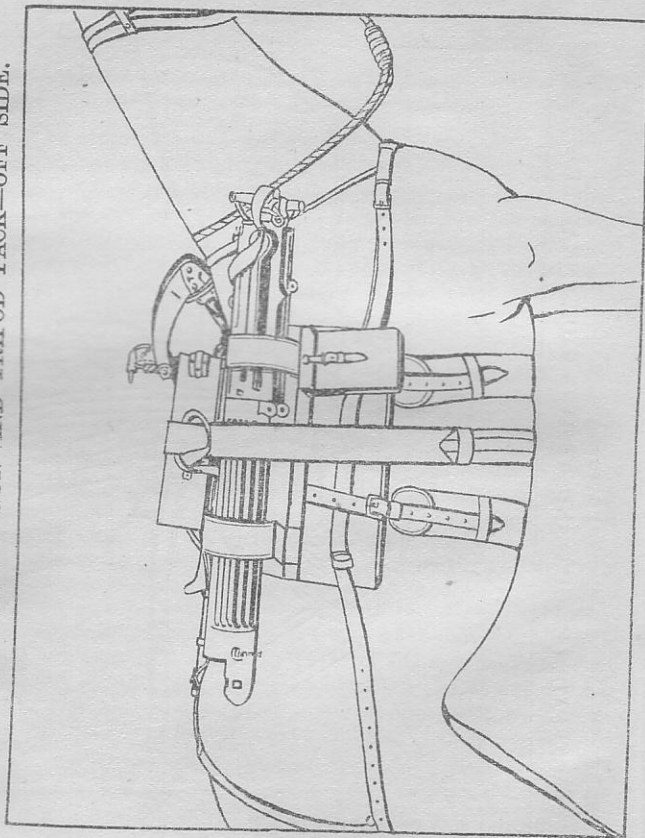
Nos. 5 and 6 will take the hangers from the rear portion of the limber, and place them on the pack saddle (off-leader), No. 5 placing the gun hanger (hanger with two narrow slings) on the off-side

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PLATE XV.

PACK SADDLE—GUN AND TRIPOD PACK—NEAR SIDE.





and No. 6 the tripod hanger (hanger with one wide and one narrow sling) on the near-side of the pack saddle.

No. 6 unties the feeds and replaces one as a top load, securing the strap of the nose-bag round the front arch of the saddle.

No. 5 takes the canvas water bucket and puts it between the front and rear arch of the saddle, the rope handle going under the rear arch and on to the rear off-side hook of the tree. No. 5 also takes the spare parts case out of the spare parts box, and passes the strap of the spare parts case under the bar of the hanger and over the front near side hook; this avoids undoing the strap.

Nos. 1 and 2 take out one tripod and gun.

No. 1 takes the tripod, and with the assistance of No. 6, places it in the near-side slings, legs to the rear, crosshead leaning towards the front arch. Nos. 1 and 6 buckle the securing straps. Care must be taken that the inner jamming handle is turned back on to the leather panel of the saddle.

No. 2 takes the gun, and with the assistance of No. 5, places it in the off side slings, muzzle to the rear, the front sling being passed over the feed block and the rear sling over the barrel casing. Nos. 2 and 5 buckle the securing straps. No. 5 takes the cleaning rod and pushes it through the gun slings, front to rear, where the metal rings are held by the leather slings.

Nos. 5 and 6 each take one belt box and place them respectively between the gun and arches of the saddle, and the tripod legs and arches of the saddle, lids facing outwards.

The Nos. 1 and 2 fix the straps, long and short, which are on the bars of the hangers, round the tripod legs and gun respectively, and buckle them on to the belly band. Nos. 5 and 6 pass the web surcingle through the belt box handles and secure under belly.

* ii. *Ammunition pack* (Plate XVII). Numbers required—3, 4 and 7.

No. 7 takes a canvas water bucket and puts it on as above, and fastens the other feed from the off-leader on to the rear side hook of saddle. No. 7 also places the condenser tube and condenser bag in the centre of the saddle, securing the sling to the front and rear arch. The condenser tube can be fixed on the gun in the "ready" position, if required.

Nos. 3 and 4 take a full ammunition rack each and hang them on to the hooks, the metal "D" on the bottom of the rack being nearest to the animal, and the lids of the boxes being away from the animal.

They now fasten the steadying strap (leather girth), each end, when long enough, being passed through the slot in the "lay on" of the pack saddle, through the metal "D" on the rack and then buckled.

No. 3 takes the oil can case and places it on the top of the near side rack.

No. 4 takes the water box and places it on top of the off-side rack. Nos. 3 and 4 then secure the web surcingle by passing it over the oil case and water box and under the animal's belly.

Wire cutters, if likely to be required, should be carried attached to the front arch of the pack saddle. Both packs are loaded simultaneously.

The gun detachment can now move off, the leading driver leading the ammunition pack animal, and No. 8 the gun and tripod pack animal.

4. "Off pack saddles."

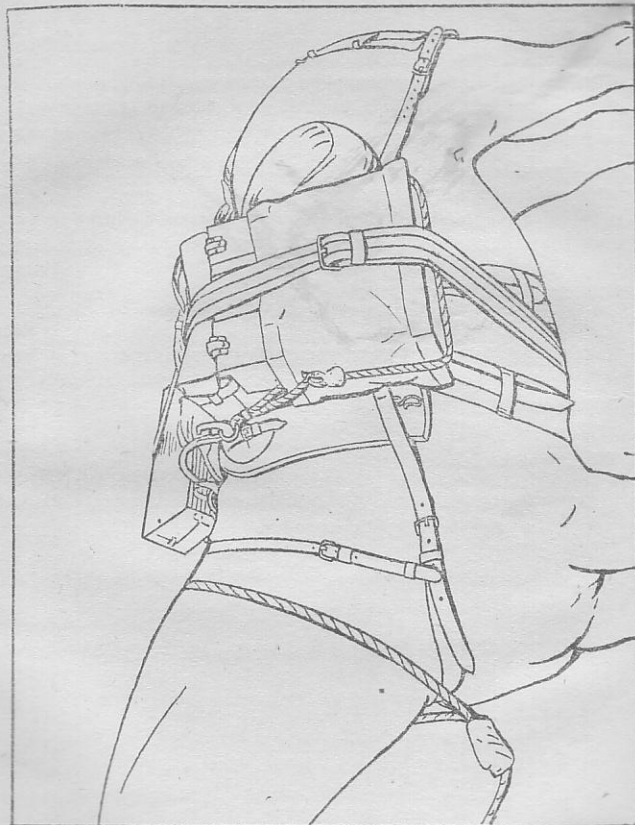
On the command "Off pack saddles," the reverse procedure will be adopted.

* NOTE.—These instructions are for equipment at present in use and require to be modified on the introduction of "stripless" belts packed in special boxes.

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PLATE XVII.

PACK SADDLE—AMMUNITION PACK.



5. Load tables.

The following load tables should be considered more in the nature of a guide than as definite instructions, owing to the necessity of adapting the loads to suit local conditions.

It is most essential that the weights be kept as equal as possible on each side. If, for example, the nosebag be empty or the barrel casing be not full of water, or some belt boxes have been emptied these facts should be taken into consideration and weights adjusted accordingly.

GUN AND TRIPOD PACK.

Nearside.	lbs.	Centre	lbs.	Off side.	lbs.
Tripod, with dials ...	52	Bucket, canvas ...	1	Gun, with barrel casing filled ...	42
Hanger, tripod, sling	9	Case, horseshoe (filled)	3	Hanger, gun, sling ...	8
Belt box ...	21	Nose bag (filled) ...	8	Spare parts case ...	8
				Cleaning rod ...	1
				Belt box ...	21
Total ...	82	Total ...	12	Total ...	80

Recapitulation of weights.

	lbs.
Near side...	82
Centre ...	12
Off side ...	80
Packsaddle ...	28
	202

AMMUNITION PACK.

Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
3 boxes, belt (single)	63	Bucket, canvas ...	1	3 boxes, belt (single)	63
Rack (canvas) ...	6	Case, horseshoe		Rack (canvas) ...	6
Case, can, oil ...	8	(filled) ...	3	Water box (filled) ...	15
Nosebag (filled) ...	8	Condenser tube and bag ...	3		
Total ...	85	Total ...	7	Total ...	84

Recapitulation of weights.

Near side...	...	...	...	...	lbs.
Centre ...	...	...	...	...	85
Off side ...	...	...	...	...	7
Packsaddle ...	...	...	...	...	84
					28
					204

29. Action from pack saddles.

“Prepare for Action.”

On the command “Prepare for Action” the gun numbers will carry out their duties as for the command “Off pack saddles” and will prepare their guns for “Action.” They will only remove those articles which are actually required from the packs.

The driver and No. 8 will assist each other to secure all loose gear and straps after the gun team moves off.

In the case of ammunition packs, care will be taken that the same number of belt boxes are removed from each rack, so that the remainder of the load is balanced.

30. Machine gun platoons whose equipment is carried entirely on pack.

Where the terrain renders it necessary or advisable (e.g., India), the equipment of a machine gun platoon may be carried entirely on pack. In this case the sets of pack saddlery differ in certain details from those described above, and the method of loading, &c., is varied.

Details regarding the packsaddlery sets, drill, &c., for platoons so equipped will be found in an addendum to this manual to be issued locally in India.

31. Machine gun troops (cavalry).

1. Cavalry machine guns are carried on pack saddles and each N.C.O. and man of the gun detachment is mounted. As speed in coming into and going out of action is of utmost importance the personnel must be thoroughly trained in the loading and unloading of pack saddles. Men should first be practised in taking the gun and tripod off and putting them on the pack dismounted, and when efficient at this, will undergo training in coming into action as a mounted section.

It is essential that every man should know how to strip the hangers and replace any damaged parts.

2. Load tables.—Details of the load tables, as well as instructions regarding the methods of loading pack saddles, are given in the Handbook for the .303 inch Vickers Machine Gun, Sec. XVI.

3. Action from pack saddles.—During the early stages of training, when the personnel is dismounted, the detachments should fall in as for “Battle Order” mounted.

On the command “Action,” the detachments will carry out the duties as laid down in “Allocation of Duties” (see Sec. 16.)

8. The best shot in each troop or platoon will be determined by his aggregate score in the classification practices.

9. Range practices will be fired in drill order.

33. Range duties.

1. During classification practices, which are tests of the results of training, officers, N.C.Os. and men from machine gun troops or platoons other than that which is firing will be detailed under the orders of general officers commanding for all duties of supervising and marking, except in the Territorial Force, where the independent supervision need be carried out in the butts only, either by machine gun officers or, when this is impracticable, by officers of the same unit.

2. For the above practices, the provisions of paras. 10 and 11 will be scrupulously carried out.

3. One officer cannot supervise at the firing point more than four firers at one time.

4. If markers cannot be found from other units, officers of other machine gun units, at least, should be specially detailed for supervision at the butts and the firing point.

5. One officer will be detailed to supervise at the butts the marking of not more than four targets.

6. Officers of the troop or platoon which is firing will be detailed to assist superintending officers at the firing point as may be necessary. It will be their special duty to report to the officer superintending on any stoppages that may have occurred when all the rounds allotted for the practice have not been fired within the time limit allowed.

7. It is essential that all supervising officers at the firing point are trained machine gun officers. If sufficient machine gun officers are not available for butt duty a proportion of other cavalry or infantry officers may be detailed for this duty.

8. For all practices other than classification, there must be equally thorough supervision by officers at the firing point, but they may in this case belong to the machine gun unit which is firing.

The duties specified in para. 11 will be carried out by non-commissioned officers under such supervision as may be considered necessary.

9. To guard against accidents the following orders will be observed in addition to those given in Musketry Regulations.

(a) No gun will be loaded until the senior officer present has ordered the practice to begin.

(b) Before the red flag is raised at the firing point, signifying cessation of fire, the senior officer present will give the order "Clear guns," when the firer will remove the lock from the lock guides and report "Gun clear." The lock will remain in this position until the order "Load" is given.

(c) The officer in charge of the left-hand section may give the signals to fire and cease fire for the whole line of guns, under the orders—by signal or otherwise—of the senior officer conducting the firing; or in the discretion of the latter, each section officer may (subject to the flag which governs the whole firing point) be allowed to carry on independently for the section under his supervision.

10. The duties of the officer superintending at the firing point are:—

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- (i) In classification practices to vary the order of firing before the commencement of practices 8, 11 and 14. (Practices 8, 9, 10, and 11, 12, 13, respectively, will be fired consecutively without leaving the firing point.)
- (ii) To see that each man on his roll (A.F. B. 2050) fires at the target (or area in the case of ranging practices) to which he has been detailed, and fires with the machine gun and tripod which has been issued to his gun detachment. In classification practices the number of the gun and tripod used will be entered on A.F. B. 2050.
- (iii) During instructional practices—
 - (a) To allow no person at the firing point but the officers, the instructors, the men actually firing and their No. 2's.
 - (b) To ensure that the regulations as to target practice and local orders are obeyed.
 - (c) To detail a N.C.O. or man to send and receive messages on the telephone or by signal.
 - (d) To detail a N.C.O. to superintend each man's firing and to instruct.
- (iv) During classification practices—
 - (a) To allow no N.C.O. or man within 20 yards of the gun positions, except the Nos. 1 and 2.
 - (b) To see that the number of rounds allowed for the practice to be fired are not exceeded, and that the belt is "spaced" as described in Sec. 34, 4.
 - (c) Before each practice to allow each firer time to examine and attend to his gun, tripod and ammunition belt.
 - (d) In timed practices to enter in the column of remarks on the roll (A.F. B. 2050) the number of points to be

deducted for any man firing after the signal to cease fire has been given (*see* Sec. 35, 9).

- (e) To see that no assistance of any kind is given to non-commissioned officers or men while they are at the firing point, with the exception of the Nos. 2 carrying out their duties at the guns.
- (f) To decide whether extra time shall be allowed, or the practice fired again, in the event of a stoppage or stoppages in the gun (*see* Sec. 35, 9).
- (g) To cause the targets to be checked immediately before every practice.
- (h) To see that the targets as erected on the butts give reasonable facilities for observing fire, either above, below, or to one side of them.
- (i) To ensure after each practice, by personal inspection, that all rounds allotted for the previous practice and not fired have been removed from the belt and the number of rounds fired are entered on the roll (A.F. B. 2050).
- (j) To see that the tangent sight is not raised during the practices fired at 400 yards.
- k) Before traversing practices are commenced, to ensure that the firers understand the direction in which they are to traverse the gun at the commencement of the practice, and also that they have an opportunity of testing their clamp.

11. The duties of an officer on butt duty in a gallery range are as follows:—

- (a) By actual measurement to ensure that the 6-inch bands forming the border of the application targets are of the correct dimensions and correctly put on the targets,

and that the vertical lines on the traversing targets are correctly marked.

To see that the outside measurements of all targets are correct, and that the targets are sufficiently clean to enable shot holes to be easily distinguished.

- (b) To see that the butts and appliances are in good order, and to report damage and deficiency.
- (c) To explain all regulations and local orders to the markers, and to ensure their observance.
- (d) To detail markers to targets.
- (e) To see that the targets placed on the stop butts are so erected that they will give the best possible observation of fire to the firers.
- (f) To see that the area allotted to a gun for ranging practices is marked by a flag or number, but that no target is erected for the purpose. (*See also Sec. 35, 8.*)
- (g) To check the application and traversing targets immediately before firing and to have patched out any hits which may have been made on them as the result of a previous practice.
- (h) To allow no one to touch the target until he is in front of it. Personally to check the target of each firer and to enter in ink the number of hits in the butt register (A.F. B. 2050A). In traversing practices to enter on the butt register the number of "spaces" which contain no hits. No erasure is to be made in the registers. If alterations are necessary a fine line will be drawn through the figures, the correct figure written against it, and the amendment verified with the officer's initials.

- (i) If more direct hits are found on a target than rounds allotted, to deduct from the score:—

The value of the highest hits in excess in application and service application practices: Two points for each hit in excess in traversing practices.

Only those hits which are to count will be entered on the butt register.

- (j) To regulate the exposure of moving and vanishing targets according to the instructions laid down.
- (k) To place a ring round each hit on the target with a coloured pencil before entering its value in the register, and to ensure that all shots are duly patched out.
- (l) On the conclusion of a practice to rule a line diagonally across the unused spaces in the register before signing it, and to hand all butt registers to the officer superintending at the firing point.

34. *Special Instructions.*

1. It is essential that the mounting and gun should be such as to enable the standard group (3-inch ring, containing 9 shots out of 10 at a range of 25 yards) to be obtained. This will be tested in the presence of the firers before Part I is fired, in the following manner:—

- i. Range, 25 yards. Target, any convenient vertical screen. Rounds, 10 (one burst of fire).
- ii. The tripod will be erected on firm ground. Experience has shown that the firing of only 10 rounds will not be sufficient to affect the size of the group, provided the ground is firm or a T-base is used.
- iii. The gun will be half loaded and laid so that the shots will strike the screen. The traversing clamp will then be tightened. No aiming mark is required.

- iv. The trigger bar will be drawn back and retained in this position by inserting a No. 3 punch between the thumb piece and the safety catch.
- v. The loading will now be completed and this will cause the gun to fire automatically until the 10 rounds are fired.
- vi. The group will then be measured. If the gun fails to group in a 3-inch ring the cause is generally attributable to the mounting. Steps must be taken to analyse the cause or causes of the failure to group, which must be eliminated before Part I is fired.

2. A similar test will be made at any time when it is suspected that the standard group is not being obtained.

3. Before Part II is fired the barrel will be tested for accuracy at 400 yards.

A target 6 feet square provided with an aiming mark will be suitable for the purpose.

A group of 10 rounds will be fired at this target, but previous to so doing a few shots will be fired into the stop butt to warm the barrel.

In order to ensure that the whole group of 10 shots will strike the target a few single sighting shots will be fired at the target and their position signalled from the butts. These single shots must be patched out before the 10 shot group is fired.

On conclusion the group will be measured and the area of the rectangle enclosing all the shots should not exceed 12 square feet. This area represents the average dispersion of a number of groups of which the figure of merit does not exceed the limit of 1.5 feet.

Should the area of the rectangle exceed 12 square feet the barrel will be tested for accuracy in accordance with the instructions given in Appendix XIII.

Note.—The above tests will be of little value unless the gun and mounting are in perfect order.

4. In the preparation of machine gun ammunition belts for classification practices each firer will load the rounds which he himself will fire. Each firer will be allotted a belt in serviceable condition for the firing of practices 8, 9 and 10. Similarly a belt will be allotted to him for practices 11, 12 and 13. Intervals of not less than 40 empty pockets will be made between the rounds allotted for each practice. When the firer has loaded his belt it will be packed into the belt box, which will then be marked with the firer's name. Before each detail fires the No. 1 about to fire will bring up his belt box, take out the belt and lay it out for inspection by the officer in charge of the firing point.

The firer will at the same time have the opportunity of finally inspecting the belt.

For practice 14 the belt will be loaded with four groups of 50 rounds each, with intervals of not less than 15 empty pockets between each group.

5. The officer commanding a platoon or party is responsible that guns are unloaded before they are dismounted at the firing point.

6. Ammunition allotted to machine gun sections is not to be expended for rifle, Hotchkiss or Lewis gun firing.

35. *Method of conducting Parts I, II, III and IV.*

Part I.

1. Part I is instructional and is carried out on the 25 yards range. As the machine gunner will have hitherto carried out little firing with service ammunition, careful and thorough instruction is necessary throughout. For this reason no time limit is placed upon any of the practices, and in order that the beginner may assimilate the lessons to be learnt all the practices of Part I should not be fired on one day. Each practice will be explained to each man

before he fires. The best value will be obtained by criticising each practice while it is in progress, ceasing fire for the purpose, rather than by waiting until the practice is finished before commencing to criticise. At the conclusion of the practice faults should also be pointed out at the target, and the firer told how to correct them.

2. The instructor at the firing point should watch the firer, *not* the target, in order that he may see that all points of elementary training are carried out correctly. The shots on the target will bear witness to any faults that the firer may have committed whilst firing. Instructors must realise that the greatest care must be taken to eradicate such faults during the firing of Part I, so that the gunner shall not carry them with him and acquire faulty actions from the commencement of his training. This applies equally to the actions of the No. 2 at the gun. The following are the points to which particular attention must be paid:—

In No. 1:—

- Correct firing position and holding.
- Quick and clear repetition of all orders.
- Quick and accurate loading and laying.
- Correct pressure on the thumbpiece on the signal "Fire."
- Eyes on the target, not looking along the sights or down at the thumbpiece when firing.
- Attention to "Points during firing."

In No. 2:—

- Inspection of ammunition and belts.
- Correct service position (not kneeling up).
- Attention given to control signals and to feeding the gun, not watching the target.
- Correct and rapid transmission of signs to "Fire" and "Cease fire."

3. As the accuracy of the first shot of each group fired by a machine gun is not reliable, one wide shot will frequently be found when examining a group, and this should be borne in mind by instructors when criticising the results of a practice or when measuring the size of a group. If the point of mean impact of a group does not strike the target $\frac{1}{2}$ inch to the right of the point of aim, the foresight must be adjusted.

4. Practices of Part I may be repeated as considered necessary by the platoon commander, provided that the total number of rounds allotted to Parts I and III is not exceeded. No record of results need be kept, but only the total number of rounds expended by the platoon in Part I.

Part II.

5. Before proceeding to fire practices 8 to 17, the machine gunner will be exercised in observation of fire on a field firing range (Practice 7). The practice will be limited to the observation of fire of one gun during this period of individual training (*see* Sec. 13, 9). It is essential that the machine gunner should appreciate the varying conditions under which observation of fire may be possible, and for this purpose the range and the area selected for the beaten zone should be varied for the different numbers of the gun detachment. Further, as detachments will benefit from observing fire under varying conditions of weather and light, it is advisable to allot several days for the conduct of this practice, so that one detachment may receive further training when other detachments are being exercised.

6. In order that they may undergo instruction, at an easy range, in applying fire from results of observation, machine gunners who are in their first year of service in the machine gun troop or platoon will carry out the following instructional

practices. These will be fired at a range of 300 yards and will be carried out after practice 7 and before the classification practices are commenced. The ammunition to be used for these practices will be that allotted for Part V. In order that the fullest value may be gained from these practices no time limit is to be imposed.

Nature of practice.	Nature of target.	Rounds.	Remarks.
Ranging	—	20	As for practice 8.
Application	Screen 6 ft. square	15	As for practice 9.
Traversing	Screen 3 ft. high, 10 ft. long	35	As for practice 10.

7. Practices 8 to 17, Part II, are fired on the Classification Range, and a strict time limit is imposed in the Classification Practices. In these the firer is classified as either a—

Marksman gunner,
First class gunner,
Qualified gunner,

according to the total score he obtains. The firer should have learnt by this time how to handle his gun, and consequently no help or criticism will be given while he is actually firing. He should be left to his own resources, with the object of developing self-reliance and confidence in himself and his weapon. The strictest possible discipline must be enforced at the firing point, and, as in Part I, all points of elementary training should be carried out correctly. In range work there is an inevitable tendency for these to be neglected, which can only be checked by the vigilance and care of section officers and instructors. Each practice and the time allowed will be explained clearly to each man before he fires.

8. Classification practices should be fired during the most favourable time of year for individual observation of fire, in order that the firer may obtain full advantage from the ranging practices. The results obtainable in the classification practices will mainly depend on the observation obtained in the ranging practices (*see also* Sec. 32, 5).

When the condition of the stop-butt is such as to render observation of fire impossible to the firer, classification practices will not be fired.

On ranges where the nature of the stop-butt is such as to preclude observation of fire by the firer, steps must be taken under local arrangements to improve the nature of the stop-butt, in order that observation of fire may be obtainable.

In this connection the use of dry ashes, placed on portions of the stop-butt, has been found to give good results.

9. In Classification Practices (8, 9, 10, 12, 13 and 14) fire will be stopped as soon as the time limit is reached.

One-fifth of the total points scored will be deducted for each second the firer continues to fire after the signal to cease fire has been given, in all practices except practice 14, when, if the target is hit 30 points will be deducted. No allowance will be made in these practices for stoppages which are due to causes other than defects of the mechanism or breakages. The firer will be given time to look over the gun and ammunition belt before each practice is begun.

Note.—Should the stoppage be due to a defect in the mechanism or to a breakage, sufficient time to remedy such stoppage will be allowed or the practice may be repeated.

10. Points will be allotted as follows :—

PRACTICES 9 and 16 :—

For each hit on the target below and including 15 :	2 points.
“ “ above 15 :	3 points.

ii. Training with ball ammunition.

This should be carried out on the following lines :—

- (a) Range 800 to 1,000 yards. Separate aiming marks. To teach fire unit commanders to observe four beaten zones. Necessity for longer bursts to give the commander TIME to observe.
- (b) Range 1,000 to 1,500 yards. One aiming mark. To teach the fire unit commander to pick out the nucleus of a combined beaten zone, and apply it.
- (c) Range 1,500 to 2,000 yards. To teach the fire unit commander, with the assistance of the Barr and Stroud rangefinder, to make use of this instrument to observe the fire of the section.
- (d) Range 1,500 to 2,000 yards. To teach the fire unit commander to make use of ground which is suitable for observation of fire, when no observation of fire can be obtained on the ground in close vicinity of the target.
- (e) Range 1,800 yards or over. Machine gun platoon (two sections). To train the platoon commander, section officers and range-takers to observe the fire of the platoon when engaging large areas of ground necessitating TIME to produce effect, and to practise communication arrangements so that subsequent fire orders can be given and acted upon.

Part IV.

13. *Field practices.*—These exercises should be carried out between ranges of 600 and 1,200 yards. The training of a machine gun troop or platoon cannot be considered complete until it has fired field practices on a field firing range.

36. Allotment of Ammunition and Summary of Practices.

Allotment of Ammunition.

	Rounds.
Part I—	
Each officer, N.C.O. and man	260
Part II—	
Each officer, N.C.O. and man	590
Part III—	
*Each officer, N.C.O. and man	80
Part IV—	
*Each officer, N.C.O. and man	100
Part V—	
*Each officer, N.C.O. and man	70

* These rounds will not be fired individually, but will be expended collectively.

Summary of Practices : Parts I, II, III, IV and V.

No.	Nature of practice.	Rounds for each man.	Total rounds for each man.
PART I.			
1	Grouping	20	—
2	Single shot traversing	20	—
3	Single shot searching	12	—
4	Oblique traversing	100	—
5	Application	40	—
6	Stoppages	30	—
Total for practices, Part I		222	—
For testing mounting and gun, and repetition		38	—
Total for Part I			260

Summary of Practices—continued. Parts II, III, IV and V.

No.	Nature of practice.	Rounds for each man.	Total rounds for each man.
PART II.			
7	Observation (up to 1,000 yards)	90	—
*8	Ranging (400x)	20	—
*9	Application (400x)	30	—
*10	Traversing (400x)	70	—
*11	Ranging (600x)	30	—
*12	Application (600x)	30	—
*13	Traversing (600x)	100	—
*14	Service application (600x)	50	—
15	Ranging (800x)	30	—
16	Application (800x)	70	—
17	Traversing (800x)	70	—
Total for Part II			590
Total, Parts I and II			850
PART III.			
Fire at long ranges, observation of the fire of a section, demonstrations and tests		80	80
PART IV.			
Field practices		100	100
PART V.			
Tactical exercises		70	70
Total for Parts I, II, III, IV and V			1,100

* Classification practices.

37. Detail of Parts I and II.

Part I.—Instructional.

To be fired at 25 yards range. Target : Instructional Machine Gun Target. (See Plate XVIII.)

No.	Nature of practice.	Target.	Rounds.	Object of practice and method of conducting.
1	Grouping ...	Plate XVIII Fig. 2.	20	To find the sighting elevation necessary to hit the point of aim. (See Sec. 48, Para. 22.) Fired in two spaced groups of 10 rounds each, directed on two different aiming marks.
2	Single shot traversing	do.	20	To practise automatic tapping. Fired in two traverses of 10 single shots each, one to the right and one to the left.*
3	Single shot searching	do.	12	To practise automatic turning of the elevating wheel. Fired in two searches of six single shots each, one up and one down.*
4	Oblique traversing	do.	100	To combine automatic tapping with quick relaying and control of the burst of fire. Fired in seven bursts of 12-15 rounds each at the seven aiming marks respectively.

* Practices 2 and 3 will be fixed concurrently, i.e., one traverse, one search going completely round the target. The firer must observe his target and not use his tangent sight (which, however, will remain raised except), for the initial laying at the commencement of each practice.

Part I.—Instructional—continued.

No.	Nature of practice.	Target.	Rounds.	Object of practice and method of conducting.
5	Application	Plate XVIII Fig. 4.	40	To teach quick application and the control of the burst of fire, and taking aim at the point where it is desired the nucleus shall fall. Fired in four bursts of fire of about 10 rounds to each. The instructor indicates the two columns M and N. The firer then fires at M, and, without further orders, immediately reloads, relays and fires at N. After criticism, the procedure is repeated, columns P and Q being indicated.
6	Stoppages	Any	30	To practise rectification of stoppages with ball ammunition. Using 30 rounds of S.A.A., belts are prepared beforehand with six stoppages per firer, viz., separated case, missfire, bad fault in feed, thick rim (specially made), two successive missfires. Any form of aiming mark may be employed that will enable the accuracy of the firer's relaying to be checked.
		Total rounds Repetition	222 38	
	Total for Part I	...	260	for each man.

Part II.—Classification.

No.	Nature of practice.	Nature of target.	Range, yards.	Rounds.	Time, secs.	Remarks.
7	Observation	—	Up to 1,000	90	—	See Sec. 35, para. 5.
8	Ranging ...	—	400	20	—	Fixed sights. Ranging fire should be carried out against a bank of earth adjacent to the target, if possible. In this practice each man has the opportunity of sighting his gun on the open range before the classification practice.
9	Application	Screen 6 ft. square. (See Plate XVIII, fig. 5.)	400	30	10	Fixed sights. Only shots within the 5-ft. square count.
10	Traversing...	Screen 3 ft. high, 20 ft. long.	400	70	30	Fixed sights. Gun to be traversed by groups from right to left; the firer is required to traverse the target with the rounds allotted within the time limit, without restrictions as to traversing backwards.
11	Ranging ...	—	600	30	—	See Practice 8. Tangent sight used.
12	Application	Screen 6 ft. square. (See Plate XVIII, fig. 5.)	600	30	15	Tangent sight used. All shots on the screen count.
13	Traversing...	Screen 3 ft. high, 30 ft. long.	600	100	35	Gun to be traversed from left to right; tangent sight used. Other conditions are the same as for Practice 10.

Part II.—Classification—continued.

No.	Nature of practice.	Nature of target.	Range, yards.	Rounds.	Time, secs.	Remarks.
14	Service application	Equilateral triangle of 4-ft. 6-in. sides, mounted on pole. (See Plate XVIII, fig. 6.)	600	50	30	The gun is loaded, and the firer is given the range. He is pointed out limits between which his target will appear; these limits should be about 30 yards apart. The angular target is hoisted at any spot and at any height between these limits on signal from the firing point. Exposure 30 seconds, after which the target disappears. Timing is done in the butts. The firer lays and fires immediately the target appears, and observes his fire. This practice exercises the firer in quick laying and application on to a difficult target, which suddenly appears at any spot.
15	Ranging ...	—	*800	30	—	See Practice 11.
16	Application	As for 9 ...	*800	70	20	See Practice 12.
17	Traversing...	Screen 3 ft. high, 40 ft. long.	*800	70	30	See Practice 13.

* Where 800 yards range is not obtainable, these practices may be carried out on a field firing range, or the ammunition may be utilized for further training in practices of Part II at the discretion of the Battalion Commander.

ANNUAL MACHINE GUN COURSE—TERRITORIAL FORCE.

The annual machine gun course for the Territorial Force will be as follows:—

PART I.

As for Regular Army. Total rounds for each man—260 rounds.

PART II.

No. of practice.	Nature of practice.	Rounds for each man.	Remarks.
7	Observation (up to 1000 yds.)	50	As for practice 7 Reg. Army.
*8	Ranging (400 yds.) ...	20	" 8 "
*9	Application (400 yds.)...	30	" 9 "
*10	Traversing (400 yds.) ...	70	" 10 "
*11	Ranging (600 yds.) ...	20	" 11 "
*12	Service application (600 yds.)	30	" 14 "
Total rounds per man ...		220	

* Classification practices.

PART III.

Fire at long ranges, &c. (see Part III for Regular Army)—50 rounds for each man.

Total rounds for each man for Parts I, II and III—530 rounds.

In order to be classified as a:—

1st class gunner—100 points must be obtained.

Qualified gunner—70 points must be obtained.

Those who obtain less than 70 points will be unqualified and will be put back for further instruction.

Fig. 3.

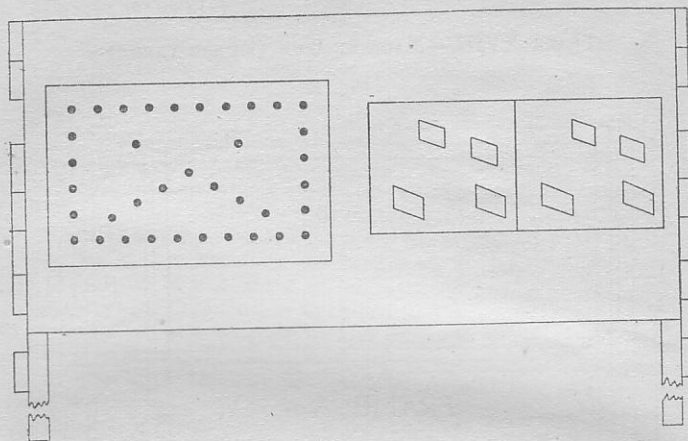


Fig. 4.

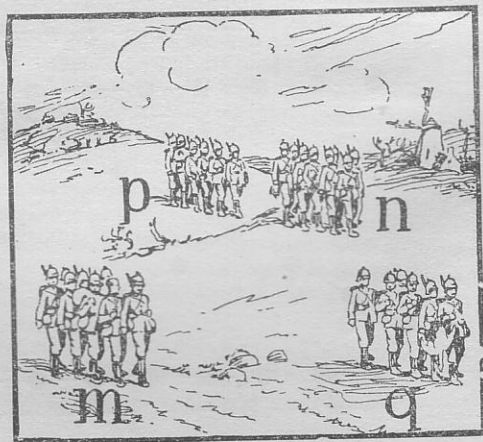
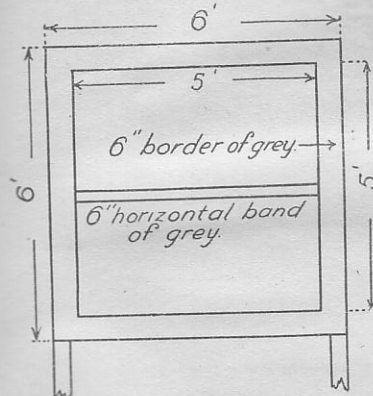


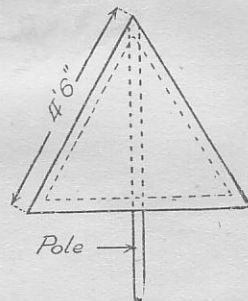
PLATE XVIII.—MACHINE GUN COURSE TARGETS (continued).

Fig. 5.



Target for Practices 9, 12 and 16.

Fig. 6.



Target for Practice 14.

Practice 13: Traversing: 600 yards.—Three screens, 10 feet long by 3 feet high, ruled in the same way as for Practice 10.

A 6-inch horizontal band is pasted on the three screens as for Practice 10.

Practice 14: Service application. (See Plate XVIII, fig. 6.)—The target consists of an equilateral triangular frame with 4-feet 6-inch sides, mounted on a 10-foot pole, and covered with brown or grey paper, according to the colour of the background. For example, a grey triangle should be used against a brown stop butt.

Practice 16: Application: 800 yards.—The same target is used as in Practice 9. All hits on the screen will count.

Practice 17: Traversing: 800 yards.—Four screens, 10 feet long by 3 feet high. See practice 13.

CHAPTER VII.

TRAINING IN FIELD OPERATIONS.

39. *General instructions.*

1. From the beginning of his training the nature of his duties will impress upon the machine gunner the necessity for close co-operation with his comrades. Field operations, therefore, should be regarded both as a continuation of individual training and as practice in the co-operation of the machine gun unit with other units and other arms in the field.

2. The following sections deal with training in the field, and with the application of the principles indicated in Field Service Regulations, Vol. II, and amplified in this manual. (*See also Training and Manœuvre Regulations, Ch. III.*)

3. In all stages of training advantage should be taken of local conditions to teach those lessons for which the nature of the ground is best suited.

4. In section training the men will first be instructed in the methods of handling machine guns in the field by means of advanced section drill and elementary tactical exercises.

When the troop or platoon commander considers that his sections are fit to take their place in the troop or platoon the latter will be exercised as a whole.

5. Schemes for brigade machine gun training should be simple, and should usually deal with the various situations which will confront machine gun units co-operating with cavalry or infantry in either attack or defence. The methods to be employed by both forward and supporting guns should be exemplified and practised, and particular attention must be devoted to the tactical use of limbers.

6. It is unwise to attempt to teach too many lessons in one exercise; it will normally be sufficient to exemplify one phase of the operations in one day's work; ample time should be devoted to discussion and the correction of faults on the ground.

7. At the end of the course of training the machine gun troops of a cavalry brigade and the machine gun platoons of an infantry brigade should, when local conditions admit, carry out continuous training of about three days duration (*see Training and Manœuvre Regulations*) under a selected machine gun officer.

8. In peace operations, owing to the absence of fire effect, and to the necessity of making a few rounds of blank last through hours of fighting, the tendency is to pay more attention to numbers, formations and consequent vulnerability of opposing forces than to fire direction, fire control and fire discipline. It is of the highest importance to guard against this tendency, and all machine gun commanders at all periods of training in the field should devote special attention to ensuring that the principles of fire tactics are correctly taught and applied, so that neither bad habits are acquired nor false lessons deduced from the more or less artificial conditions of peace operations.

9. Exercises in the field will be carried out under service conditions as regards equipment unless climatic conditions make this inadvisable. Blank ammunition will be used in carrying out the more advanced exercises.

40. *Training in use of ground and methods of advancing under fire.*

1. The machine gunner will receive practical instruction in the use of ground. He should be taught that the use of ground, and of the cover it affords, is based on producing the maximum fire power with the minimum of exposure.

2. Ground and artificial features are used for concealment of :—

- (a) Movement.
- (b) Gun positions.

As regards the latter it must be realised that the occupation of a gun position is governed by :—

- i. Fire effect.
- ii. Concealment.
- iii. Cover from fire.
- iv. Inter-communication and ammunition supply.
- v. Nature of the operation in hand.

3. Attention must be paid to the following points :—

- i. The use of ground to obtain the greatest possible concealment in approaching the position of readiness. To effect this the correct handling of limbers is essential.
- ii. The method of approach to the gun position as regards carrying the gun, tripod and ammunition boxes. Within reasonable limits, concealment is of greater importance than rapidity. The gun should be sited as low as is compatible with the necessary field of fire.
- iii. The difference between cover from view and cover from fire must be explained, and with regard to the former, the value of background in relation to the selection of a gun position in the open must be impressed on all ranks.

iv. The value of camouflage must be demonstrated, and men must be practised in the use of simple and practical materials for the purpose.

v. Instruction must be given in methods of concealment from aircraft, by troops on the move or when at rest.

4. The loads carried by machine gunners in action render the gun detachment conspicuous.

On occasions, therefore, when man-handling is necessary, within view of the enemy, the gun detachment should simulate the formations and movement of infantry as much as possible.

41. *Training in reconnaissance and instruction of scouts.*

1. Whilst all ranks should be trained in reconnoitring, observing and reporting the result of their observations, the training of the machine gun officer in reconnaissance is of great importance.

Officers who may be called upon to carry out reconnaissances should be capable of executing rough maps and of writing a concise report containing only such information as will be of use to the officer for whom it is intended, and which is relevant to the object in view. They must also be able to make out visibility charts. If an area is being reconnoitred for machine gun positions the report should commence with a brief description of the area reconnoitred and of the positions available with their special advantages or disadvantages.

The positions recommended to be occupied should then be given and information furnished on such points as the following :—

- i. The approaches, whether concealed or exposed; and the nature of the ground, whether hard or boggy.
- ii. What formation machine gun units can advance in.
- iii. Positions of readiness in their vicinity.
- iv. Suitability for direct or indirect laying.
- v. Nature of ground surface, e.g., plough, grass, &c.

- vi. Number of guns for which there is room at full interval.
- vii. Best positions for observation of fire. (*See also* Sec. 59, 3.)
- viii. Positions for limbered wagons.
- ix. Description and position of any natural screen in front or to the flanks.
- x. Necessity for any field work.
- xi. Best method of protecting the position from surprise; dead ground in front or to the flanks.
- xii. Best lines of advance from the position and the extent to which they are concealed from view.
- xiii. Obstacles to movement, such as streams with high banks and bogs.

If time admits a rough map on a scale of about 4 inches to 1 mile, showing the proposed positions of the guns and limbered wagons, the approaches to them and the position of any natural screens will be a valuable addition to the report and will often save much writing.

Concurrently with the above, any information obtainable on the following points should be noted and reported:—

- (a) Description of the enemy's position giving approximate relative heights.
- (b) Likely positions for the enemy's guns or observation stations.
- (c) Any earthworks that can be observed.

2. In the actual reconnaissance of areas for gun positions, attention should be paid to the following points:—

- i. The field of fire must be adequate for the task in hand, and for effective co-operation with adjacent machine guns.
- ii. Cover, especially from view, should, whenever possible, be found for the position and its approaches, and for the gun detachment.

Fire effect, however, should rarely be sacrificed for the sake of cover.

iii. A position of readiness must be selected, under cover, and close to the gun position, to which the troop, platoon, or section can be directed prior to coming into action.

iv. Positions must be provided for observation and control.

Observation of fire and of the movement of our own and hostile troops should be obtained from positions under cover, and preferably within sight of the gun position. Control of fire should be direct, if possible.

v. The route of approach to the position of readiness, and from there to the gun position, should be under cover: for this, a detour may have to be made. Ease of inter-communication and supply will largely depend on the nature of the route selected. The fact that communications to alternative positions may be required must also be borne in mind.

vi. Positions for transport must be found. Limbers or pack transport should be brought as close to the gun position as cover will allow, although, if the situation so demands, cover may have to be sacrificed to speed of action.

vii. Arrangements must be made for local protection when in action. In this connection the question as to whether an escort will be required must be considered.

viii. When hostile fire compels a change of position, the guns should be moved to an alternative position. This should be selected as soon as the original position has been chosen. There should be a covered approach, and, as nearly as possible, a similar field of fire to that of the original position.

ix. Lines of advance or retirement to the next position must be selected.

3. The above instructions apply to officers, but in order that N.C.Os. and selected men employed on reconnaissance work may be of use to them, they will require training in the following subjects:—

i. *Map reading*.—They should be able to find the way in a strange country, first, by practical map reading; then by memory of the map; by sun and compass; by landmarks; by questioning natives of the country. As maps may not always be available on service, they should be practised in working without their aid.

It should be a habit with them to notice the general direction taken and changes of direction subsequently made.

ii. *Sketching*.—When they have learnt to read a map, elementary instruction in sketching should be given. This to include instruction in conventional signs; judging distances by time or by eye; making a simple approximate scale, finding approximate north point; sketching a piece of simple country; drawing a map from memory; estimating heights.

iii. *Reporting*.—As the value of the men's work depends largely on their ability to furnish a clear report they should receive instruction in this subject. Written reports should be in telegraphic language, and verbal reports thought out beforehand.

iv. *Concealment*.—Their attention should be drawn to the great importance of taking cover and of selecting a background to suit the colour of their clothing when observing; the importance of remaining perfectly still; of avoiding the sky line; of selecting look-out points when on the move, and of getting from one point to another quickly, and unseen.

4. In almost any given situation, prior to taking part in an attack, a subordinate machine gun commander will be given definite tasks by the officer commanding the force with which he is co-operating. Having been allotted his task, the machine gun commander will be allowed to carry it out in such a way as he may think best, subject to certain conditions of time and space, which will vary according to the nature of the operation. In most cases his task will have been allotted to him when he is still some distance from the enemy. Reconnaissance should be his first consideration, and the following description of the action of a troop or platoon commander under these circumstances indicates the procedure to be adopted normally:—

i. Explain thoroughly to his command the nature and scope of the task in hand, stating his intentions.

ii. Direct one of his section officers to lead the troop or platoon to a point (under cover from view of the enemy) in the direction of the locality where it is intended to come into action. This point may have to be selected off the map, but it will often be possible to indicate it to the ground. It should not be too near the locality selected for coming into action, in case change of direction is found necessary.

iii. Proceed as quickly as possible well ahead of his command to reconnoitre the hostile position and the locality in which the troop or platoon is to come into action. During this reconnaissance he should be accompanied only by such men as are essential for the purpose and for communication between himself and his command, e.g., one or two scouts and a range-taker. It may also be advisable for him to take a section commander with him.

- iv. During the reconnaissance select a suitable line of approach for the troop or platoon from the point to which it has been directed to the actual gun position.
- v. Select the gun positions with due regard to the task in hand. Indicate ranges to be taken by the range-taker.
- vi. Send back one of the party to lead the troop or platoon into position. Look for alternative positions.

Many other minor details will require attention, but unless something like the above procedure is adopted the troop or platoon will blunder into action with correspondingly bad results.

5. In addition to the scouts and runners on troop or platoon headquarters, at least one man in each gun detachment will be specially trained in the duties of scouts; such training will be carried out principally during the period of individual training. This special training should be conducted by a selected officer, under whose charge all the above men should be placed for a definite period.

6. The methods to be adopted in the training of scouts should be left to the officers concerned. The standard to be aimed at is that a scout should fulfil the following conditions:—

- i. Be of thoroughly sound physique and in good condition.
- ii. Know how to observe.
- iii. Be able to read a map easily.
- iv. Know what to report on, and how to make a report.
- v. Be able to express himself clearly and concisely.
- vi. Possess good sight and know how to use his eyes and ears.
- vii. Be self-reliant, resourceful, and prepared to take risks.
- viii. Understand semaphore signalling, and, if possible, be acquainted with all methods of visual signalling.
- ix. Thoroughly understand the use of ground; be able to move about and see without being seen.
- x. Be able to judge distance accurately and estimate numbers correctly.

- xi. Be able to form sound conclusions from signs, such as clouds of dust, footprints, and so on.
- xii. Understand how to guide himself by compass, by the sun, and by stars.

7. The value of the work done by scouts depends to a very great extent on the orders they receive before they are despatched on a particular duty. Every party of scouts sent out must have a particular objective assigned to it, and must be given specific questions to answer. The rôle of scouts is to observe and report, and, when engaged on their special duties, they will only use their rifles in self-defence.

The commander who despatches parties of scouts must arrange with them for means of rapidly communicating any intelligence gained.

During peace operations scouts should not be allowed to employ methods which would be impossible in war.

42. *Field engineering: Duties in billets, camps, or bivouacs; Sanitation.*

1. The machine gunner should have learned during the period of individual training how to use the various forms of tools, and the elementary principles of field fortification.

During his training in field operations, he should be taught to apply his knowledge to the construction of such field works as may be required to be undertaken by machine gunners in war.

2. Particular attention will be paid to the construction of such machine gun emplacements as can be completed quickly in war without expert supervision or assistance. Details regarding such emplacements are laid down in the Manual of Field Works (All Arms) Part I, Chapter V. The general principles governing the siting of machine gun positions are given in Secs. 115 and 117.

3. Instructions regarding duties in billets, camps or bivouacs are given in Field Service Regulations, Vol. II, Chapter V.

4. The efficiency of a unit depends largely upon its general health. The preservation of health and the prevention of disease are therefore incumbent on every officer and soldier.

This can be secured only by strict adherence to the laws of sanitation. This subject is fully dealt with in the Manual of Military Hygiene, of which all ranks must have a general knowledge.

The idea that sanitation is the province of the medical service alone is entirely erroneous and must be strongly combated, as also must be the tendency to overlook its broader application and to regard it as dealing only with scavenging, disposal of refuse, and arrangements for conservancy.

Though much of the work of disease prevention is of a technical nature, which must be left to experts, all ranks should appreciate the reasons for the various sanitary measures taken, and should realise that they are personally responsible for whole-hearted co-operation in these methods, and that a low percentage of sick in their unit is a sign of their unit's efficiency.

43. *Training in marching.*

1. The general rules and principles regarding marches and march discipline are laid down in Field Service Regulations, Vol. II, Chapter IV, and amplified as regards the man in Infantry Training, Vol. I, Chapter IX.

2. The power of undertaking long and rapid marches without loss in numbers and energy is one of the chief factors of success in war, and is as essential to the efficiency of the machine gunner as to that of the infantry soldier.

3. In addition to route marching in marching order, the machine gunner must be trained in carrying machine gun loads over considerable distances, since his efficiency in battle will largely depend on

his ability to carry the gun, tripod and ammunition loads whenever conditions debar the use of limbers or pack animals.

4. Marching in rear of transport increases the fatigue of a man. As a general rule, therefore, on long marches, when not in contact with the enemy all the limbered wagons of brigaded machine gun platoons should march in rear of the platoons. On the other hand, when action is expected, it will usually be advisable for the platoon limbers to march in rear of each platoon.

5. The following rules will be observed by machine gun units as regards the march discipline of transport and the care of animals :—

(a) *Before starting.*

i. Before commencing a march, commanders should make certain that harness and saddlery are correct, that shoeing has been properly attended to and that the animals are fit for the march. A small supply of bandages, old puttees and blankets is required for galls, &c.

ii. If it is not likely to be possible to water animals during the first few hours of the march, a very early start should be avoided, since horses and mules will not usually drink early in the morning.

Even when marching at an early hour a small feed should be given before starting.

iii. Sufficient time should be allowed each morning for the men to saddle up carefully, but on no account should animals be harnessed up or hooked in an unnecessarily long time before starting.

(b) *At the halt.*

i. A careful examination should be made of animals, harness, saddlery, and vehicles at every halt, especially at the first one. Drivers must be trained to examine their animal's feet and to report injuries, breakages, &c. ;

they must realise the importance of dealing with an incipient gall immediately it is noticed.

- ii. At halts of 10 minutes or over, whenever the tactical situation allows, girths should be slackened and poles lowered, but traces need not be unhooked. It is of great importance to relieve horses or mules as much as possible of the heavy weights they have to carry. When they are standing in harness the drivers should be dismounted.
- iii. Opportunities which may occur for watering and feeding should always be seized. Watering must be carried out on a regular system if it is to be done smoothly and expeditiously: it must be supervised by an officer. In dusty weather the eyes and nose should be sponged out whenever possible.
- iv. At the halts, officers' chargers must be on the same side of the road as the rest of the column, and should face the centre of the road if standing on it. Care must be taken when continuing the march that officers' chargers do not block the road.

(c) *During the march.*

- i. In all circumstances an even pace must be maintained throughout the column. If a check is unavoidable the suddenness of it may be reduced by pulling into the side.
- ii. Drivers must ensure that all the animals in a team do their fair share of work: this cannot be obtained unless the former apply their legs and whips correctly.
- iii. Drivers must not lounge in their saddles, as this is liable to cause sore backs.
- iv. During training the position of mules or horses should frequently be changed: a led mule, for example, loses

his back muscles if he is never ridden, and is also apt to acquire the habit of leaning on the off side of the bit. This change of position may be necessary on a long march.

- v. The brake should be put on sufficiently tight to check but not to skid the wheels. In crossing a valley the brakesman must begin easing it off soon enough for the wheels to be quite free before the beginning of the rise on the other side is reached.

44. *Training in night work.*

1. Night work must not be regarded as a separate operation of war, but as the natural sequence of operations carried out by daylight, and the soldier must be accustomed to perform after dark all the acts required of him by operations carried out in daylight.

2. Individual training in this respect will be commenced during recruit training, will be carried out progressively in the unit, and should embrace the following subjects:—

- i. Visual training.
 - ii. Training in hearing.
 - iii. Methods of advancing silently, carrying tools or machine gun loads.
 - iv. Training in orientation.
 - v. Entrenching at night.
 - vi. Training of transport in moving by night, including instruction in methods of obviating noise.
 - vii. Use of pack transport, and changing from limbers to pack.
3. Since the co-operation required from machine guns in either attack or defence is limited to the production of fire, the importance of night firing (see Sec. 80) is evident, and the machine gunner must receive thorough instruction in the limitations of and methods to be adopted in carrying out night firing.

45. *Posting and relief of sentries: relief of units.*

1. The object of this instruction is to give practice in :—
 - i. Posting and relieving sentries, and Nos. 1.
 - ii. Relief of sections.
 - iii. Coming into action from cover.
 - iv. Quick changes to alternative positions.

2. *Kit required :—*

Gun (barrel casing filled with water).
 Condenser tube and condenser, half filled with water.
 Mark IV tripod.
 Two belt boxes (6, if available), belts and dummies.
 Spare parts case.
 Auxiliary aiming mark.
 Clinometer.
 Range card.
 Machine gun trench bag.
 Water box, or tin.
 Signal pistol (not to be fired near the gun position).
 Box respirators.

3. *Posting and relief of sentries by day.*

The following procedure will be carried out when relieving sentries within a gun detachment :—

The principles involved are identical with those for the posting and relief of a sentry on guard or outpost duty.

By day, one gun number only need be on duty at the gun position; he is the sentry.

He will always be posted by a N.C.O., who will explain the orders to him, and be certain that these orders are understood.

The tripod and two belts in boxes will be in the position; the remainder of the team and equipment will be under cover.

The sentry will be given the following details and orders :—

- i. Definite orders as to his action in case of attack.
- ii. Exact location of all gun positions allotted to his gun, and their numbers or names.
- iii. Points shown on the range card, and extent of the front to be watched.
- iv. In case of alarm, to warn the commander and team.
- v. Standing orders for sentries; special orders for the gun position.
- vi. Special information—*i.e.*, patrols, wiring parties, danger from snipers, the position of our own and hostile infantry, &c.
- vii. Positions of guns on either flank.
- viii. Position of the officer.
- ix. Position of the nearest telephone and latrine.

4. *Posting and relief of sentries by night.*

By night double sentries will always be posted, one being the No. 1 for the tour of duty. Both will be near the gun and on the look-out.

The gun will be mounted in the position, half loaded and laid on the night line. Four belt boxes and the spare parts case will be in the position.

The posting of the double sentries will be performed by a N.C.O., who will make certain that the sentries understand their orders.

Each No. 1, after being posted, will inspect the gun to make certain that it is in thorough working order and ready to open fire on completion of the loading motion. He will see that all necessary equipment is in place, and will be informed of any special fire orders for night firing from the position.

NOTE.—All sentries, both by day and night, will also act as gas sentries.

5. Relief of sections.

The guide with the relieving section will lead it to the position of the section to be relieved, and report to the commander of that section that the relieving section has arrived.

(a) The officer in charge of the relieving section will :—

- i. Report to the officer of the section to be relieved.
- ii. Remain with him and receive reports from his N.C.Os.
- iii. Receive any instructions or information with regard to the situation, other than those he has learnt during his previous reconnaissance.
- iv. As soon as the relieved section has moved off he will go round all his guns and make sure that his gun commanders have carried out their work correctly. At the same time he will see that any special orders he may have issued with regard to work to be done, &c., are being complied with.
- v. Report "Relief complete" to his machine gun commander, and to the commander of the sector.
- vi. See that his arrangements for communication are on a satisfactory basis.

(b) The relieving N.C.O. will :—

- i. Ascertain the positions of the guns and the sentries, alternative emplacements, his officer's headquarters, the nearest telephone and the latrine. He will also ascertain the night lines for the guns.
- ii. Take over and give a receipt for trench stores.
- iii. Ensure that his Nos. 1 understand their orders and range card, and show them the alternative emplacements.
- iv. Detail his first sentries, and see that they are properly posted.

- v. Order his Nos. 1 to mount their gun, and see that this is done correctly.

NOTE.—When the relief is by night precautions must be taken that the incoming guns are laid on the correct line. (See Sec. 80.)

vi. Report to his officer "Relief complete."

vii. Draw out a duty roster.

(c) The relieving sentry will ascertain the orders for the sentry as detailed in paras. 3 and 4.

(d) The officer in charge of the section relieved will not move off until his section is reported closed up and complete.

6. The relief of units larger than a section should be carried out on lines similar to the above.

46. Duties in case of gas alarm or gas attack.

1. Duties in case of the alarm "Gas" or "Gas shells."

i. All ranks will adjust their box respirators. The gun and spare parts will be well oiled.

ii. *By day.*—On the alarm being given, the sentry gives the alarm to the other numbers, completes the loading motions and lays. No. 2 immediately takes post at the gun, and the remaining numbers stand by under cover.

When "stand to" is ordered, the above procedure is carried out by the machine gun detachments, but the gun is only half-loaded.

iii. *By night.*—On the alarm being given, No. 1 completes the loading motions. The other sentry will waken the other numbers, and return to his post.

2. Action during and after a gas attack.

i. During a gas attack:—

(a) The gun will be kept firing, or

(b) The gun, ammunition boxes, and spare parts case will be completely covered with ground sheets or blankets.

ii. After a gas attack, the gun, its equipment and the ammunition will be thoroughly cleaned. (Handbook for the 303-in. Vickers Machine Gun, Sec. C., para. II.)

PART II.

FIRE DIRECTION.

CHAPTER VIII.

GENERAL CONSIDERATIONS.

47. *Introduction.*

1. Fire direction is the selection and application, in conformity with the tactical situation, of the best method of engaging any given target.

2. In the field, tactics and fire direction are interdependent branches of machine gunnery. Both are based on the characteristics of the gun and are comprised in the term "fire tactics."

The main object of all fire is to cover movement. Normally therefore, machine gun fire is "covering" fire, and it will usually be overhead fire for delivering which the machine gun is eminently fitted, owing to the stability of the mounting from which it is fired (see Sec. 82).

The duty of machine guns is to support the infantry, or in the case of machine gun troops the cavalry, by assisting them

to gain superiority of fire. To carry out this rôle successfully, volume of fire is essential. To obtain the requisite volume of machine gun fire it is necessary to have a number of guns under one control. For this reason the section of four guns is to be regarded as the normal unit for purposes of fire direction and control.

3. Before commencing the study of fire direction, as applied to machine gunnery, the student must be thoroughly familiar with the Manual of Map Reading and Field Sketching.

A thorough knowledge of topography and of elementary mathematics is essential to the machine gun officer; he must be able to use a prismatic compass with accuracy, and must be trained to recognise ground features as they appear on maps of various scales. A fair knowledge of field sketching is also of advantage to him.

48. Definitions and elementary ballistics.

1. *The axis of the barrel* is an imaginary line following the centre of the bore from breech to muzzle.

2. *The line of departure* is the direction of the bullet on leaving the muzzle, i.e., the prolongation of the axis of the barrel at the instant of explosion.

3. *The line of fire* is a line joining the muzzle of the gun and the target.

4. *The line of sight* is a straight line passing through the sights and the point aimed at.

5. *The culminating point* is the greatest height above the line of sight to which the centre of the cone rises in its flight. This is reached at a point a little beyond half the distance to which the cone travels. (For the definition of a "cone" see below.)

6. *The trajectory* is the curved path taken by a bullet during its flight.

7. *Cone of fire* (Fig. 2).—The figure formed in the air by the several trajectories of the bullets fired, and bounded by the trajectories of the outermost shots of a burst of fire.



FIG. 2.

8. *First catch* (Fig. 3).—The point where the bullet has descended sufficiently to strike the head of a man, whether mounted, standing, kneeling or lying.



FIG. 3.

9. *First graze* (Fig. 4).—The point where the lowest bullet, if not interfered with, will first strike the ground.



FIG. 4.

10. *Beaten zone* (Fig. 5).—The area of ground beaten by a cone of fire—

- i. The length is great compared with the width.
- ii. The approximate dimensions of the beaten zones of the Vickers gun are given in the range tables, Appendix I. Only the best 90 per cent. of the shots is taken into account.

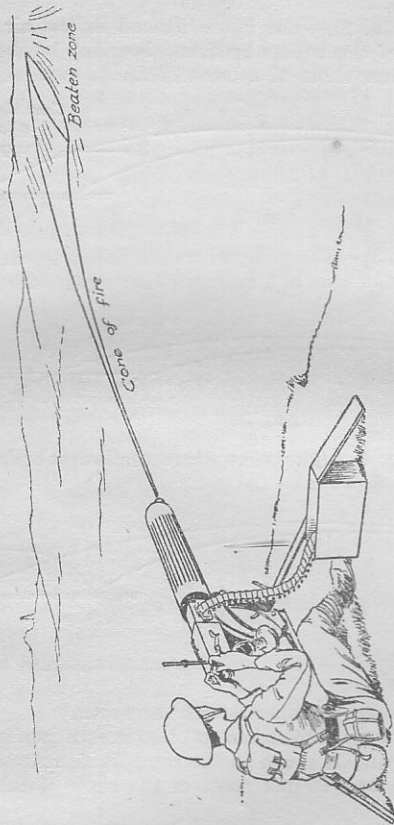


FIG. 5.

11. *Dangerous space* (Fig. 6).—For any particular range is the distance between the first catch and the first graze.



FIG. 6.

12. *Dangerous zone* (Fig. 7).—In a burst of machine gun fire the dangerous zone is an area equal to the beaten zone plus the area formed by the dangerous space for the lowest bullet.



FIG. 7.

13. *Defiladed zone* (Fig. 8).—The area of ground which would be included in the beaten zone, but for the fact that it is unswept by fire by reason of the gradient of the ground being greater than the gradient of the bullets.



FIG. 8.

14. *Angle of sight* (Figs. 9 and 10).—The angle contained between the line of sight and the horizontal plane.

By convention, the angle is said to be positive (+) when the target is above the horizontal plane, and negative (−) when the target is below the horizontal plane through the gun position.

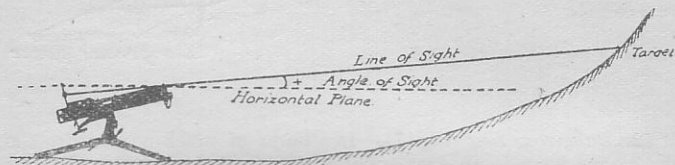


FIG. 9.

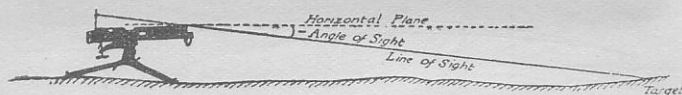


FIG. 10.

15. *Angle of tangent elevation* (Fig. 11).—The angle which the line of sight makes with the axis of the bore. For the sake of brevity this angle will be known as the tangent angle, and will be so referred to throughout this manual.

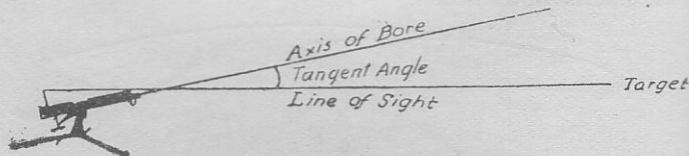


FIG. 11.

Note.—The angle of tangent elevation is so called because it is put on by means of the tangent sight. The tangent sight derives its name from the fact that the stem of the sight forms a tangent to the circle of which the centre is the tip of the foresight and the radius the distance from foresight to backsight when the latter is in its lowest position, *i.e.*, the sight radius of the gun.

16. *Quadrant angle* (Fig 12).—The angle which the axis of the bore makes with the horizontal plane.

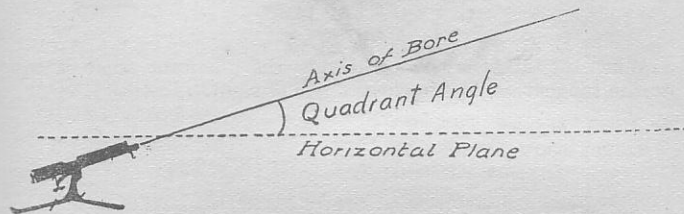


FIG. 12.

Note.—Relation between the quadrant angle (Q.A.), tangent angle (T.A.), and angle of sight.

(a) Target above gun (Fig. 13).

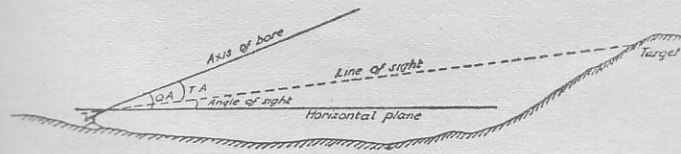


FIG. 13.

When the target is above the gun, the quadrant angle is equal to the tangent angle plus the angle of sight

(b) Target below gun (i) (Fig. 14).

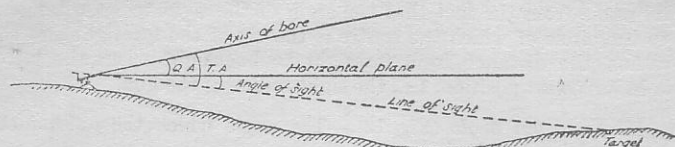


Fig. 14.

When the target is below the gun, the quadrant angle is equal to the tangent angle minus the angle of sight.

Target below gun (ii) (Fig. 15).

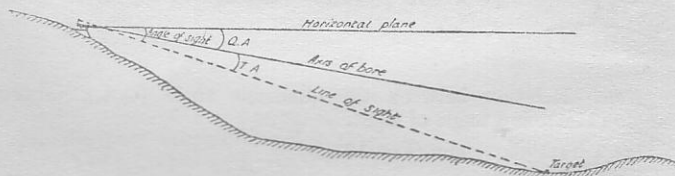


Fig. 15.

In the case where the target is so far below the gun that the angle of sight is greater than the tangent angle, the quadrant angle is negative. (This, of course, really amounts to depression.)

From the above it will be seen that the relation can be expressed by the general formula:— $Q.A. = T.A. \pm S$, where S = angle of sight.

17. *Angle of descent* (Fig. 16).—The angle which the tangent to the trajectory, at the point of impact, makes with the line of sight.



Fig. 16.

GT = line of sight.

GOT = trajectory.

T = point of impact.

DT is the tangent to the trajectory at the point of impact.

Then angle DTG = Angle of descent.

For all practical purposes this can be calculated in the following manner (Fig. 17):—

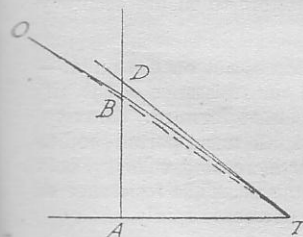


Fig. 17.

OBT is the trajectory.

AT = line of sight.

DT = tangent at point of impact.

Then if AT = 100 yards, the trajectory BT will be practically coincident with the tangent DT, and we can assume that the angle BTA = DTA.

The distance BA can be found for any range, from the trajectory graph. (Appendix II.)

Then angle BTA = $\frac{BA}{AT} \times 3,400$ = Angle of Descent.

Example.—Find the angle of descent for 1,800 yards.

From the trajectory graph find the height BA, i.e., the height of the 1,800 yards trajectory at 1,700 yards. This equals 12 yards.

Then angle of descent = $\frac{BA}{AT} \times 3,400 = \frac{12}{100} \times 3,400 = 408$ min.

(Compare Column 3, Appendix I.)

18. *Rifling.*—A gun barrel is said to be rifled when it has spiral grooves cut down the “bore.” Rifling a barrel enables an elongated bullet to be used; the advantage of this form of bullet is that it has great weight in proportion to the surface directly opposed to the air. It has, therefore, greater power of overcoming the resistance of the air, thus keeping up its velocity. When the charge is fired the bullet is forced into and follows the grooves up the barrel, thus leaving the muzzle with rotation on its longer axis. This tends to keep its point foremost and therefore to ensure accuracy of flight.

19. *Forces acting on the bullet.*—Three forces act on the bullet—the explosion of the charge, gravity, and the resistance of the air. The explosion of the charge drives the bullet forward. Gravity, i.e., the natural attraction which draws all unsupported bodies towards the centre of the earth with ever-increasing velocity, acts on the bullet immediately it leaves the muzzle. The resistance of the air causes the velocity of the bullet to decrease rapidly.

20. *Trajectory.*—The combined effect of these forces causes the bullet to travel in a curved line called the trajectory, the curvature of which becomes more pronounced the longer the bullet is exposed to their action.

21. *Elevation.*—In order to allow for the fall of the bullet it is necessary to direct the line of departure as much above the object to be hit as the bullet will fall below it if the axis of the barrel of the gun is pointed at the mark. This raising of the barrel to allow for the curve of the trajectory is termed “giving elevation.” The target must of necessity be kept in view; the gun is therefore provided with sights which permit the firer to give the elevation required whilst keeping his eye fixed on the mark.

22. *Sighting of guns.*—In the sighting of machine guns a “mean” graduation for each range has been adopted, and a high general standard of accuracy for all practical purposes is thus obtained. Each machine gun is carefully tested before issue, but it must be understood that no two machine guns behave in exactly similar manner, and that even if compensation could be made for every error in the sighting of the gun before issue the wear of mechanism and barrels, the packing of barrels and other adjustments, the wearing of the gun mounting, &c., would combine to bring about faults from time to time. It is therefore necessary that every machine gunner should study from the first the shooting and peculiarities of his gun, and make himself thoroughly acquainted with any incorrectness of the graduations marked on the tangent sight in order that he may be in a position to give his gun the correct elevation for the estimated or ascertained range to the target. Further, it should be explained to the machine gunner that, owing to the close grouping of machine gun fire, ignorance on his part of the correct sighting elevation of the gun may result in partial or even total loss of effect.

23. *Jump.*—Owing to the shock of discharge a vibratory or wavy motion is set up in the barrel at the moment the bullet leaves the bore, and the muzzle is usually deflected from its original axis. It therefore rarely happens that the line of departure coincides with the axis of the barrel before firing and the angle between the two is known as the angle of jump. Jump may be either positive or

negative, according as the muzzle is deflected upwards or downwards with reference to the axis of the barrel. With Mark VII ammunition, which gives a muzzle velocity of 2,440 feet a second, the jump is "negative" in Maxim and Vickers guns, and is allowed for in the sighting. Lateral jump has also to be considered, but as variations can be allowed for by adjusting the position of the foresight to the right or left, it is of less importance.

24. *Drift*.—Drift is the term used to express the lateral deviation of the bullet after it has left the barrel. This deviation, which is considerably less than that caused by the jump, is brought about by the rotation of the bullet and the position which it assumes in its flight.

The left-handed rifling of the service machine gun barrel causes the bullet to rotate from right over to the left, and, owing to gyroscopic action, the point works over slightly to the left. The consequent increased air pressure on the right side of the bullet therefore forces it to the left.

The deflection due to drift at distances below 1,000 yards is negligible. At 1,500 yards it may be regarded as about 7 feet.

The causes and extent of jump and drift are more fully dealt with in the Text Book of Small Arms.

49. *Fire effect in relation to slope of ground.*

1. On level ground the length of the beaten zone varies considerably with the range; but also at any particular range the length of the beaten zone varies with the inclination of the ground to the line of sight.

2. A forward slope, as shown at AN in Fig. 18 will have the effect of shortening the beaten zone on the ground: a reverse slope, as shown at AR, lengthens it.

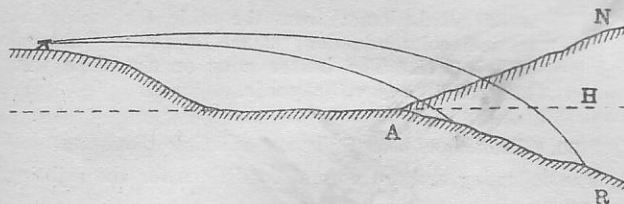


FIG. 18.

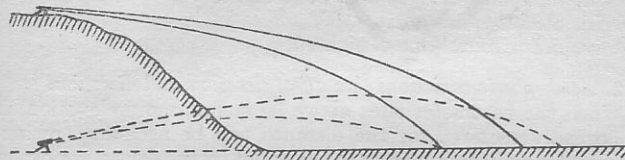


FIG. 19.

Similarly, the beaten zone of a gun firing from a commanding position on to level ground will be shorter than that of a gun firing, at the same range, from a position on the same level as the ground on which the beaten zone falls (see Fig. 19).

3. As an approximate guide to the amount of reduction or increase in the case illustrated in Fig. 18 above, the table given in Appendix III has been compiled by graphical methods. The method of use is best illustrated by an example—

- i. Range 2,000 yards: gradient of near slope (such as AN, Fig. 18), on which shots are falling, is found from the map to be 1 in 20; the beaten zone at 2,000 yards

is 130 yards long: from the table, the factor in the vertical column under "2,000" opposite "near slope $\frac{1}{30}$ " is 0.78. The beaten zone on the slope will be $130 \times 0.78 =$ say, 100 yards.

50. Climatic and other influences and their allowances.

1. The following are the normal conditions for the sighting of small arms—

- i. Barometric pressure. 30 inches. (Sea level.)
- ii. Temperature. 60 deg. Fahrenheit.
- iii. Still air.
- iv. A horizontal line of sight.

2. Atmospheric variations that affect elevation and direction.

When the barometer rises above 30 inches, more elevation than is normally required for the distance will be necessary, owing to the greater resistance offered to the bullet by the denser atmosphere. If the barometer falls below 30 inches, or at a height above sea level, less elevation will be required, as the atmosphere will offer reduced resistance to the bullet. In the same manner the bullet meets with less resistance in hot weather when the thermometer is high, and greater resistance in cold weather when it is low. ¶

3. Winds from front or rear also demand allowances in elevation.

Side winds affect direction and are a much more difficult problem. The effect of winds is far greater at long ranges than at short, owing to the greatly increased time of flight allowing the wind much more time during which to act on the bullet.

4. The graph of allowances for climatic variations (see Appendix IV) enables corrections for temperature and barometer heights to be calculated rapidly, and also shows the allowances necessary for winds.

It is used as follows:—

i. Barometer curve.

This gives the allowance necessary for a variation of one inch from the normal, *i.e.*, for a barometrical pressure of 29 inches or 31 inches. If the barometer stands below normal, the allowance must be deducted; if above, added.

For variations of more than 1 inch a proportionately greater allowance than that given by the curve must be made.

ii. Temperature curve.

This gives the allowance necessary for a variation of 20 deg. from the normal, *i.e.*, for a temperature of 40 deg. or 80 deg. Fahrenheit. If the temperature is below normal, the allowance must be added; if above, deducted.

For variations of more than 20 deg. a proportionately greater allowance than that given by the curve must be made.

NOTE.—Variations of less than 1 inch in the barometer or 20 deg. in temperature need not be considered, unless they give allowances which have both to be added or both deducted.

iii. Head or rear wind curve.

This gives the allowance necessary for a wind of 20 miles an hour. For a head wind, add the allowance; for a rear wind, deduct. For a wind of greater or less strength a proportionately greater or less allowance than that given by the curve must be made.

iv. Side wind curve.

This gives the allowance necessary for a wind of 20 miles an hour blowing at right angles to the line of fire. It is applied as a deflection towards the flank from which the wind is blowing. For a wind of greater strength a proportionately greater allowance than that given by the curve must be made. For a wind of less strength a

proportionately less allowance than that given by the curve must be made.

Halve the allowance for oblique winds.

5. *Effect of not having a horizontal line of sight.*

i. As previously stated, one of the normal conditions under which a machine gun is sighted is that the line of sight shall be horizontal. When this condition obtains, the forces acting on the bullet cause it to travel on its greatest curve, and the normal tangent angle for any given distance must therefore be given to the gun.

ii. When firing up or down hill, the tangent elevation required gets less as the angle of sight increases, until when firing vertically upwards or downwards no tangent elevation is required at all.

It is very improbable, however, that it will be found necessary to engage a target at an angle of sight of more than 10 deg. (except hostile aircraft, which is provided for on the special sights issued), and it also happens that no allowance need be made for angles of sight less than 10 deg. Hence no table for correction is necessary.

CHAPTER IX.

DIRECT FIRE.

51. *Introduction.*

1. Direct fire is the normal and most effective method of engaging a target and should, therefore, be employed whenever possible. The gun will be laid by adjusting the sights to the required range, and by tapping and elevating or depressing as laid down in elementary drill.

2. As the beaten zone of a machine gun is long and narrow, it is necessary, in order to make the most efficient use thereof, to engage the target in such a manner that as large a part of it as possible falls within the beaten zone. Thus, a linear target should, if possible, be engaged by means of enfilade or oblique fire.

3. If, however, the object is to prevent the advance of the enemy on a given frontage (*i.e.*, a linear target having depth) frontal fire may be preferable provided that sufficient guns are available, as full advantage is then taken of the depth of the beaten zone.

4. The fire unit for direct fire is the section, being the largest unit which can be controlled by one officer. The troop or platoon commander directs the fire of his two sections but only under exceptional circumstances can he actually control their fire.

In a war of movement it will often be necessary, for tactical reasons, to divide the section into two subsections. The employment of single guns, however, must be avoided. Single gun

detachments have neither the personnel nor the equipment for detached duties, and the fire of one gun will seldom be effective at the longer ranges.

5. Owing to wear of mountings and barrels, it is possible that for any particular gun, corrections may have to be made when setting the tangent sight for any given range. It is, therefore, important that the correct sighting for each gun should be known to the gun commander and men of each detachment. Guns should be tested for 500, 1,000 and 1,500 yards and the corrections carefully noted. This will be done by setting the tangent sight to the range to the target and applying fire by turning the elevating wheel (without touching the tangent sight slide) until the beaten zone is on the target. Then without touching the elevating wheel, the tangent sight slide will be moved up or down until the sights are correctly aligned on the target.

52. Factors to be considered in the application of fire.

1. In order that fire may be correctly applied to any given target, it is necessary to overcome errors of direction and elevation and to distribute the fire according to the size and shape of the target to be engaged.

2. *Errors of direction.*—The usual cause is wind. The graph (Appendix IV.) shows the lateral deflections necessary when the velocity of the wind is known. Owing, however, to the difficulty of correctly estimating this velocity, it will seldom be possible to make certain of striking a definite point by firing on it continuously with the same point of aim, unless observation of fire can be obtained. Every effort should be made to obtain observation of fire, as by so doing all errors, whether of direction or elevation, can be eliminated. This subject has been dealt with in Sec. 13. Unless observation can be obtained on the target, it is necessary to direct fire, not only on what is believed to be the correct point of aim, but also on points

to the right and left. The result of this is that a greater width of ground is engaged, thus making sure that the target has been included. Fire should be directed under such circumstances up to 30 minutes right and 30 minutes left of the estimated correct point of aim.

3. *Errors of elevation.*—These are caused by—

- (a) The difficulty of finding the correct range to the target; and
- (b) Climatic variations.

The former is by far the more important. The latter has been already dealt with in Sec. 50.

Unless observation can be obtained and all errors eliminated, as explained in the preceding paragraph, it may be necessary to fire not only with the estimated correct elevation, but also with greater and less elevations. The result of this is that a depth of ground greater than that of the beaten zone will be engaged, thus making sure that the target has been included.

The necessity or otherwise for adopting this procedure is discussed in the following paragraphs.

4. *Permissible and probable errors in range-finding.*

(a) *Permissible error in range-finding.*

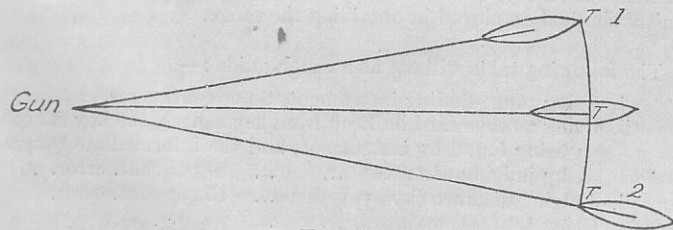


Fig. 20.

Suppose a target to be engaged which is 1,800 yards away (Fig. 20). Then, if the centre of the beaten zone hits the target (T), the lowest shot of the beaten zone will hit the ground 70 yards short of the target, and the highest shot 70 yards beyond the target, because the length of the beaten zone at 1,800 yards is 140 yards.

If the centre of the beaten zone falls 70 yards short, the highest shot only will hit the target (T1).

Or if the centre of beaten zone falls 70 yards beyond the target (T2), only the lowest shot will hit the target.

It is clear then, that if an error of more than 70 yards is made in obtaining the distance to the target (T), the whole of the fire effect will be lost, because the target will not be hit. Seventy yards can be called the permissible error, and it is half the length of the beaten zone.

In general, the length of beaten zone decreases, as the range increases, and consequently the permissible error *decreases* as the range increases.

(b) *Probable error in range finding.*—Whether the fire be direct or indirect, the range to any given target can rarely be obtained with complete accuracy, and the magnitude of this probable error depends on the method employed in obtaining the range.

The following table will act as a rough guide :—

- | | |
|--|-------------------------|
| i. Using range-finding instrument, 5 per cent. error. | |
| ii. Using a range card built up from key ranges, the key ranges being found by instrument, and the intermediate ranges by judging distance ... | ... 10 per cent. error. |
| iii. Judging distance (by eye) ... | ... 15 per cent. error. |
| iv. Using 1/10,000 map ... | } Within 5 per cent. |
| v. Using 1/20,000 map ... | |

This means that a target can never be considered as a point, for there will always be a certain length in which the target may lie.

For example.—Suppose with a range-finding instrument it is found that the range to a certain target is 1,800 yards (Fig. 21).

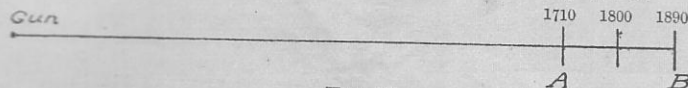


FIG. 21.

(Then, as an error of 5 per cent. (= 90 yards) may have been made either way, the target may lie anywhere between the points A and B which are 1,710 yards and 1,890 yards respectively from the gun.)

To ensure effect it will therefore be necessary to include the line from A to B in the beaten zone, which must be at least 180 yards in length, *i.e.*, twice the probable error.

At a range of 1,800 yards the beaten zone is 140 yards long. It is, therefore, obvious that unless the beaten zone at the range employed is at least twice as great as the probable error in range-finding, the fire of one gun will not necessarily be fully effective, even when the correct range has been obtained, unless some method of increasing the beaten zone is employed.

5. The methods by which the commander of one gun, acting singly, can effect this are limited, but they form the basis of all fire direction, and apply to the control of several guns. These methods are dealt with in Secs. 55 to 57.

53. Rules for flanking fire.

1. When fire is carried out directly to a flank of our own troops, the following precautions must invariably be taken—

- The limit of the line of fire GB (Fig. 22) must not be closer than 3 deg. to the line joining the gun and the flank of our own troops GA.

fire laterally (*i.e.*, "traversing") and in depth (*i.e.*, "searching"), so that it is certain the target has been included.

55. Searching.

1. *Definition.*—The method of engaging any required depth of ground by applying successively overlapping beaten zones from one or more guns.

2. It will be seen that searching is of little value when surprise effect is desired, because by this method each part of the target is engaged successively.

Suppose the target lies somewhere between the points A and B (Fig. 23) then to ensure hitting it, the whole distance AB must be engaged.

The firer places a burst on A, then elevates his gun and places another on C, then on D, and continues until the whole line has been covered.

3. It requires much skill on the part of the firer to avoid gaps between bursts, and proficiency can only be obtained by constant practice.

The firer is taught on the 25 yards range to turn the elevating wheel after firing a burst, so that the next burst of fire is 4 inches above the first. This is called the "normal" or "fifteen minute" turn, and ensures overlapping of successive beaten zones.

G is the gun position (Fig. 24).

A and B the positions on the target of two bursts of fire, the necessary elevation being given to the gun after the first burst to raise the point of impact to B, which is four inches above A.

Using the V.I. formula (*see* Sec. 65):—

$$\text{The angle B.G.A.} = \frac{4 \times 3,400}{25 \times 36} = 15 \text{ minutes (approximately).}$$

4. The firer should also be trained to apply his fire in suitable volume. Suppose the target is 1,200 yards away and a burst

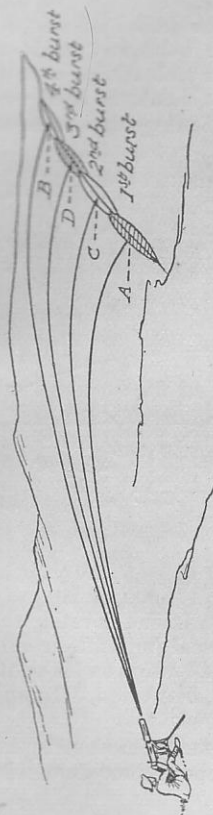


Fig. 23.

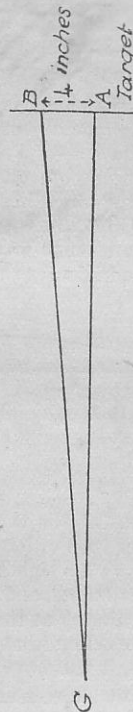


Fig. 24.

of five rounds is fired. The length of the ground covered by that beaten zone may be 240 yards, and the width is 7 yards, and it is clear that the effect of five bullets on such a large area will be very small. Bursts of 40 or 50 rounds should be fired, or even more, if there is reason to suppose that the target is a dense one.

5. When searching is being employed to overcome errors in range-finding (the object at present under discussion) the following is the procedure :—

The officer controlling the fire decides between what limits the target lies (say, between 1,200 yards and 1,500 yards) (Fig. 25).

He orders range to near limit (*i.e.*, 1,200 yards).
Then he indicates the target.

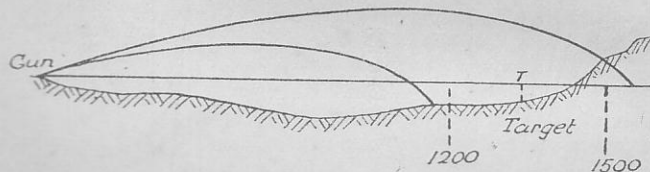


FIG. 25.

No. 1 aims at the target with smaller range (1,200 yards).

The officer then orders range to far limit (1,500 yards).

No. 1 alters his sights to 1,500 yards without elevating the gun.

No. 1 fires bursts, and elevates by normal (or "fifteen minute") turns until aiming at the target with 1,500 yards on his sights.

Then, providing that the target lay between 1,200 yards and 1,500 yards, it will have been effectively engaged.

6. When it is necessary to engage a target having depth which lies on a steep forward slope, the above procedure will need modification, as shown below.

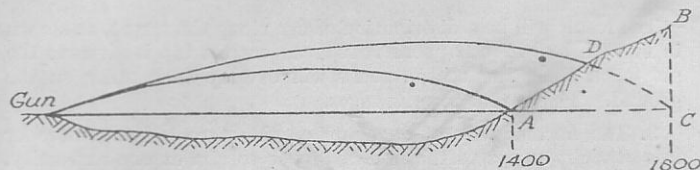


FIG. 26.

Example.—AB is a long target on a forward slope (Fig. 26), A being 1,400 yards, and B 1,800 yards from the gun. If the rule given in para. 5 be followed, the firer will elevate until aiming at A with 1,800 yards on his sights, but although his fire would, in the absence of ground at D, go to a point C, 1,800 yards along the line of sight, it will not touch B the far end of the target,

In such an instance the firer should fire and elevate until aiming at the far end of the target.

56. Traversing (single gun).

1. *Definition.*—The method of engaging any required width of ground by distributing fire laterally against it.

2. Traversing is employed either (a) to engage a target having greater width than that of the beaten zone at the range employed, or (b) to counteract possible errors in direction.

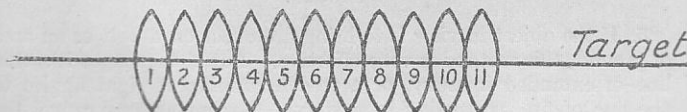


FIG. 27.

The result will be a distribution of fire along the target, as shown in Fig. 27, and it so happens that if the correct tap is given to the gun each time, the beaten zones will overlap each other on the ground. This is true for all ranges.

3. The normal way of engaging a wide target, lying more or less at right angles to the line of fire, is to aim at one extremity, fire a burst and then tap and fire alternately until the whole target has been covered.

The firer is taught on the 25 yards' range the required strength of tap to cause the horizontal distance between bursts to be 4 inches on the target at 25 yards. This is called the "Regulation fifteen minute tap." It is equivalent to a traverse of 15 minutes (see "fifteen minute turn," Sec. 55).

4. It is sometimes advisable, however, not to distribute the fire by traversing with absolute regularity, as this may afford the enemy some clue as to where to expect the next burst of fire. In such cases, the firer should switch his fire from one portion of the target to another, without any attempt at a systematic traverse, in the manner indicated in Fig. 28, where the order of the bursts is shown by the numbers against the beaten zones.

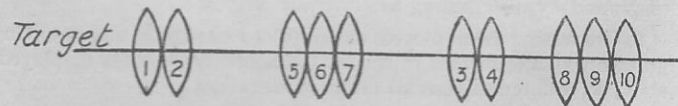


FIG. 28.

5. If the object in view is to bring fire effect on a belt or an area of ground, this method is very effective. But if the target is a thin line of extended infantry, or a trench running at right angles to the line of fire, traversing is wasteful. Except at long range, the best fire effect is obtained by firing in enfilade, or as obliquely to the target as possible.

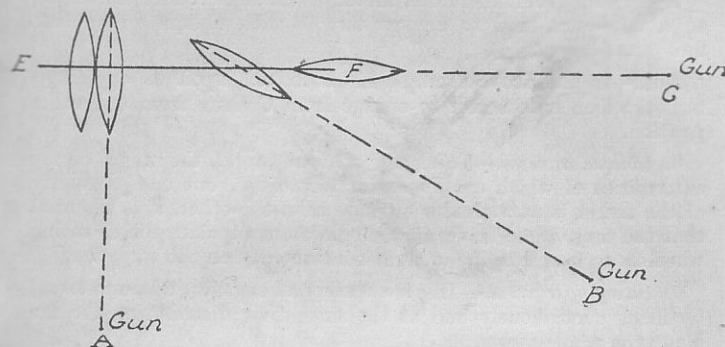


FIG. 29.

EF is a line of extended infantry at 1,000 yards (Fig. 29).

The beaten zone is 300 yards long and 5 yards wide.

Then if EF is engaged from A (*i.e.*, frontally), only the width of the beaten zone can be counted as effective (5 yards).

If EF is engaged from C (*i.e.*, in enfilade), the whole length of the beaten zone (*i.e.*, 300 yards) can be counted as effective. The fire effect produced will then be 60 times as effective from C as from A.

From B (*i.e.*, obliquely) the fire effect will be greater than from A, and the effect will increase the nearer the fire approaches to enfilade.

It will also be seen that the time taken to cover the whole target EF from B will be much less than from A.

Every endeavour, therefore, should be made to reduce traversing to a minimum, and to engage targets with oblique or enfilade fire.

Note.—In the above example EF is looked upon as one single target, which it is better to engage from C than from any other position.

6. *Oblique traverse.*—To engage a linear target, the ranges of the extremities of which are approximately equal, but one extremity of the target is at a greater altitude than the other, it is essential that the firer, while traversing, should so manipulate the elevating wheel as to keep his line of sight continuously on the target.

7. *Swinging traverse.*—This is a method of engaging a lateral target by firing continuously and at the same time distributing the fire along the whole target.

It necessitates loosening the traversing clamp, which allows the gun to vibrate more than in ordinary tap traversing, and it is, therefore, not so accurate as the normal method of traversing.

Consequently the swinging traverse should not be used, except at dense targets which are not more than 500 yards distant.

B.—DIRECT FIRE OF GUNS CONTROLLED IN SECTIONS.

57. *Combined sights.*

1. The methods of fire described in the preceding sections can be applied to the fire direction of several guns acting under a single control. In this case the use of combined sights affords an additional method of overcoming errors in range-finding.

2. *Definition.*—The method of engaging any required depth of ground by applying overlapping beaten zones simultaneously from two or more guns.

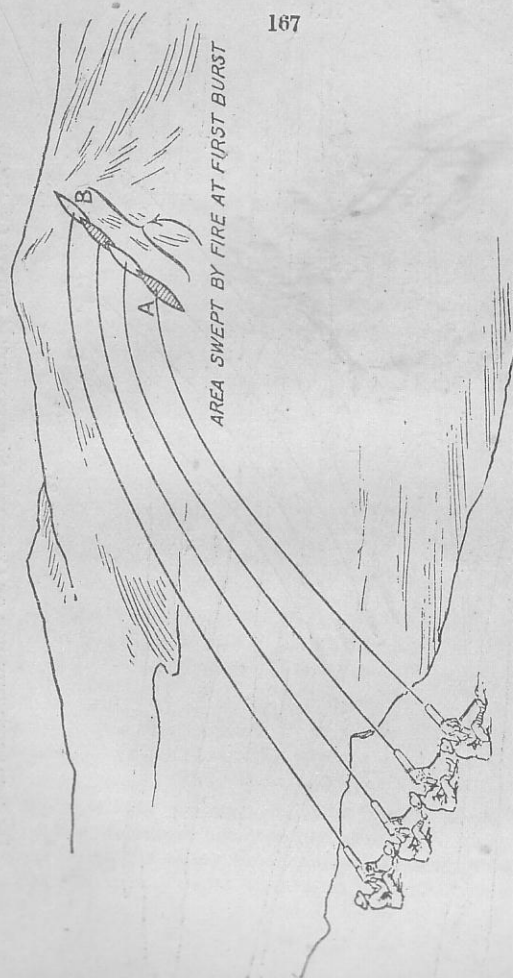


Fig. 30.

USE OF COMBINED SIGHTS—SINGLE AIMING MARK.

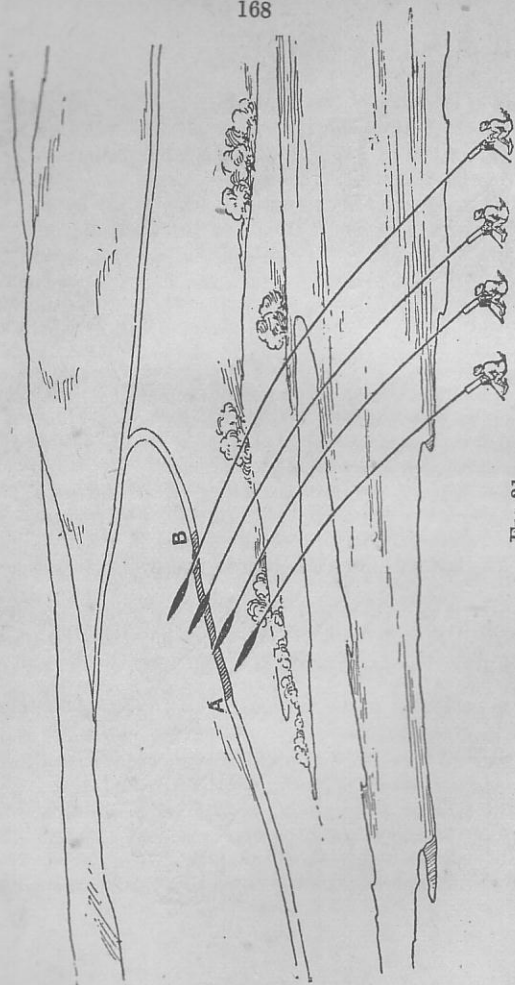


Fig 31.

ILLUSTRATING THE USE OF COMBINED SIGHTS WITH 4 POINTS OF AIM.

3. The depth of the beaten zone is increased by ordering different elevations to be used by each gun, either (a) with all guns using the same aiming mark (Fig. 30) or (b) with each gun using a different aiming mark. (Fig. 31.)

In direct fire these different elevations are put on by ordering each gun to fire with a different range on the tangent sight. In indirect fire the same effect is produced by ordering a different quadrant angle for each gun.

4. *Rule for combined sights.*—Always use 100 yards differences if the depth of ground to be covered is considerable, and 50 yards differences if it is small.

5. From Figs. 30 and 31 it is clear that the use of a single aiming mark is suitable when engaging a narrow target having considerable depth, whilst the use of different aiming marks should be resorted to either when the target is broad and shallow, or in order to overcome possible errors in direction.

In the latter case, observation of the separate beaten zone is possible, so that each gunner can pick out his own beaten zone. This is not the case when only one aiming mark is used, owing to the difficulty of distinguishing the beaten zones of the respective guns.

6. It is clear that the likelihood of hitting the target (which lies between A and B) (Figs. 30 and 31) is greatly increased by the use of combined sights, but as the fire is spread out its density will be greatly diminished.

Consequently, whenever observation of fire can be obtained, the officer controlling the fire must cease using combined sights, and order all guns to fire with the correct elevation to hit the target.

When, however, the target is itself a depth of ground, *e.g.*, a wood, combined sights will be maintained, even though fire effect on a particular part of the target has been observed.

7. Cases will arise in which the combined beaten zones of two guns will cover sufficient depth of ground to ensure the inclusion

of the target, and when at the same time it is required to engage a certain width of front.

In such an instance it would be uneconomical to use combined sights with four different elevations, as a greater depth of ground than necessary would be covered. Combined sights "by sub-sections" should, therefore, be employed. Each sub-section, using two elevations, will then engage half the frontage. An additional advantage will be the halving of the time required to cover the whole frontage to be engaged.

8. "Combined sights" is especially useful when surprise effect is desired, because each portion of the ground in which the target probably lies is beaten simultaneously.

The use of combined sights is not necessary for ranges up to 900 yards inclusive, except against targets having considerable depth, because at those ranges the length of the beaten zone is more than twice the highest probable error in range-finding. (*See Range tables, Appendix I.*)

9. When using combined sights, with a single point of aim, the officer will decide from the number of guns available, and from the length of the target, whether he should use 100 yards or 50 yards differences in order to cover the whole target.

If the target is on a forward slope it will generally be advisable to use 100 yards' differences, in order to counter-balance the shortening of the beaten zone which arises when firing on such a slope.

Example.—AB is a road, the near end being 1,200 yards and the far end 1,600 yards from the gun (Fig. 32).

Then although a distance CD (400 yards) is covered *along the line of sight* (because all guns will have the same line of sight to T), only a part of the road AB will be covered, namely, EF.

In order to cover as much of AB as possible, spread out the fire by ordering 100 yards' differences.

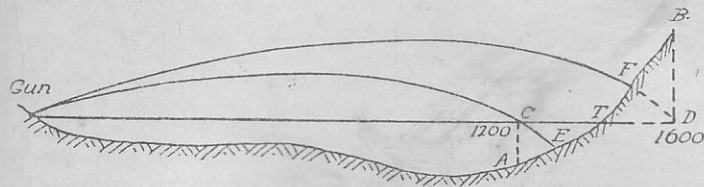


FIG. 32.

58. Traversing (platoons or sections).

1. When a section is ordered to engage a wide target, the usual method of distributing fire over the allotted frontage will be as follows:—

The two flanks of the target will be indicated, that named first being known as the "inner" flank, and the order "distribute" will be given. Each gunner will then select that portion of the target which corresponds to the position of his gun in the section, lay on its inner flank and traverse, when fire is opened, to its outer flank.

Should the order to distribute have been preceded by the order "by sub-sections"—"combined sights," each sub-section will engage and traverse half the target, taking one point of aim initially for the two guns. (*See Sec. 57, 7.*)

2. When an oblique linear target has to be engaged, the best method to employ is usually a combination of combined sights and traversing. An example is shown in Fig. 33, the fire order for which would be:—

1,200, add 100.
Column on road.
Left end to right end.
Distribute.
Fire.

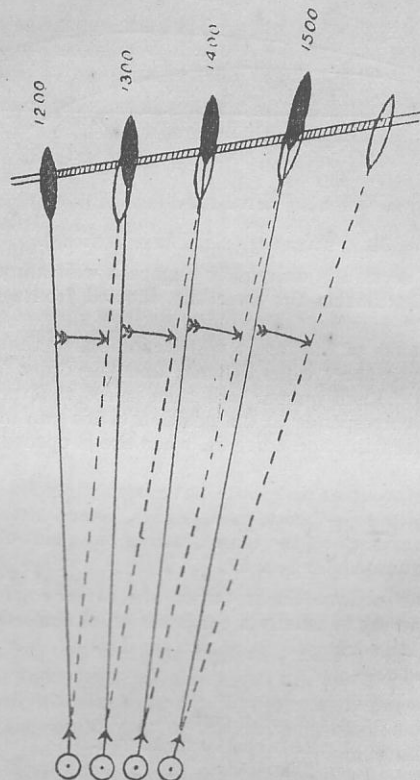


FIG. 33.

3. When it is desired to engage a target which has considerable depth and width (*i.e.*, an area) it will usually be necessary to use combined sights with a single point of aim and to traverse across the whole target with all the guns.

59. Control.

1. In the application of fire by several guns acting under one control, all the methods discussed in the preceding sections may be employed singly or in combination. But the successful application of fire will often be obtained only by a combination of several of those methods. Herein lies the secret of good fire-direction. The following example will serve to illustrate this point.

2. A section officer has observed a hostile column marching along a road at a range of 1,500 yards. He orders fire to be opened with combined sights and different points of aim (Fig. 31).

Fire effect is observed on part of the column which immediately scatters on both sides of the road (Fig. 34). The officer at once orders "cease fire."

He then orders the left sub-section, with combined sights and a single point of aim, on to the left hand end of the area in question; the right sub-section, with combined sights and a single point of aim, on to the right hand end of the area. Inwards traversing.

This is not the only method by which this target might be suitably engaged, but serves to illustrate the point under discussion.

3. It must be realised that, except when fire is carried out in accordance with a definite time-table (*e.g.*, in position warfare), a machine gun commander cannot always control the fire of his guns effectively from a position at or close to (*i.e.*, within speaking distance of) the gun position.

Good control of fire will depend on (a) observation of fire; (b) observation of our own troops and of hostile troops or their position.

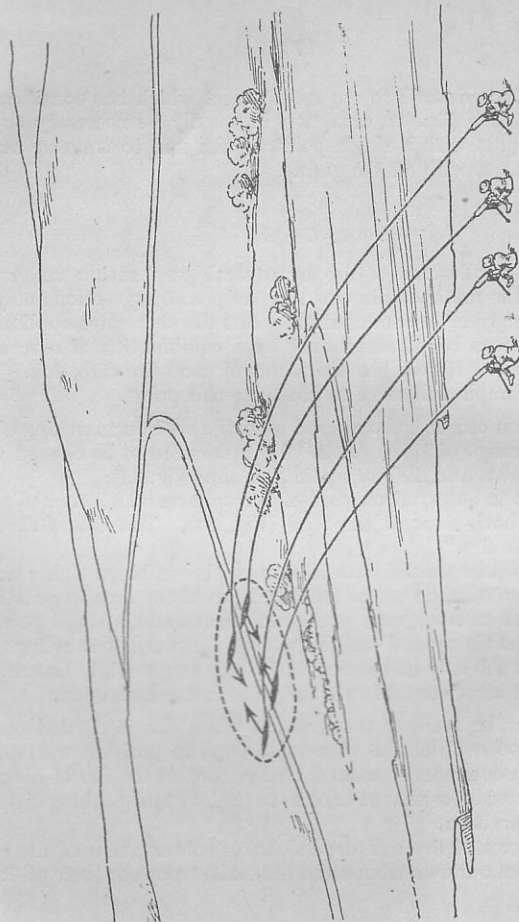


Fig. 34.

ILLUSTRATING THE APPLICATION OF COMBINED SIGHTS AND TRAVERSING
TO A SPECIAL TARGET.

Such observation will often be obtainable only from a point at some distance from the gun position, and in such case the effectiveness of the control will depend in large measure on the means of communication available between the officer controlling the fire and the gun position.

The selection of an observation post for the above purpose will be an important factor in the preliminary reconnaissance for the selection of machine gun positions (*see* Sec. 41, 2).

CHAPTER X.

DIRECT OVERHEAD FIRE.

60. Introduction.

1. It has long been an accepted principle of infantry tactics that, whenever the ground permits, an advance should be assisted by fire directed at the enemy over the heads of the assaulting troops.

For this type of fire action, in which the safety of the troops whose advance is being covered is a primary consideration, the machine gun, by reason of its fixed mounting and the close grouping of its fire, is characteristically fitted.

2. To secure the safety of the advancing troops, it is necessary to ensure that the bullets shall pass at a certain minimum height above their heads.

When direct fire is employed the desired security is obtained by the use of a safety angle or by means of a safety clearance (see Sec. 62, 5).

3. The safety angle is the angle between the firer's line of sight to the target and a line from his eye to a point on the ground in front of and below the target.

The position of this point is determined by the measure of the safety angle to be employed.

The magnitude of the safety angle employed depends on the range to our own troops.

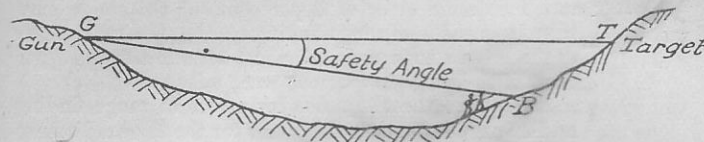


Fig. 35.

Suppose the safety angle shown in Fig. 35 is that for the range GB. Then it is safe for the firer at G to fire on the target until the advancing troops meet the line GB.

61. Rules for direct overhead fire.

- 1.—i. Range must be known to within 5 per cent.
- ii. If the troops fired over are in movement, they must be kept under observation with great care.
- iii. The mounting must be in good order.
- iv. Good barrels must be used.
- v. The range to our own troops must never exceed 2,000 yards.

Note.—The above are applicable also to indirect overhead fire.

- vi. If the range to our own troops is 1,000 yards or under, the safety angle is 30 minutes.

If the range to our own troops is over 1,000 up to 1,500 yards, the safety angle is 60 minutes.

If the range to our own troops is over 1,500 yards, the safety angle is 90 minutes.

2. Notes on the preceding rules.—i. The calculation of the safety angles given in Rule (vi) is based on the following considerations—

- (a) That a maximum error of 5 per cent. of the range may have been made in range-finding.
 - (b) That the beaten zone may fall short an additional 10 per cent. of the range for various reasons.
 - (c) Over and above the allowance for errors in range finding and firing, allowance is also made for the known distance of the lowest shot of the cone below the centre shot.
- ii. In rule (v) there is no limit to the range from gun to target.
 - iii. Rules (i) to (iv) are practical precautions for minimising the errors allowed for in rule (vi), and thus making the safety of the attacking troops absolute.
 - iv. In addition, the officer controlling the fire must allow for climatic conditions, especially for head winds.

62. Methods of applying safety angles.

There are three methods of applying safety angles—

1. *Method I. By graticuled field glasses.*—Place the zero graticule on the target and note the point at which the line from the eye through the 30 minutes, 60 minutes, or 90 minutes graticule, as required by the range to our own troops, cuts the ground.

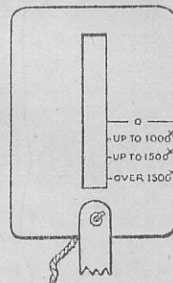
2. *Method II. By graticule card.*—When a graticule card (Fig. 36) is used, the procedure is as follows—

Holding the card vertically at the full length of the string from the eye, align the card so that the line of sight from the eye to the target passes through the zero line on the card. Holding the card steady in this position, look along whichever line corresponds with the range to our own troops, *i.e.*, for ranges up to 1,000 yards use the 1,000 line; over 1,000 up to 1,500

yards, the 1,500 line; above 1,500 yards, the over 1,500 line. If our own troops are below the line applicable they are safe, but the point in their advance at which it will be necessary to apply a greater safety angle must be carefully ascertained, *e.g.*, when our troops pass a point 1,000 yards from the gun, the 60 min. angle must be used instead of the 30 min. When our own troops reach the safety limit, sights will be raised 500 yards and the guns re-laid on the target. Fire may then be continued until our own troops pass the objective.

Notes.—1. When using the graticule method the card should not be held more than 6 feet above or below the gun and at approximately the same range from the target.

2. On flat ground the method described in para. 5 should be used.



GRATICULE CARD.

FIG. 36.

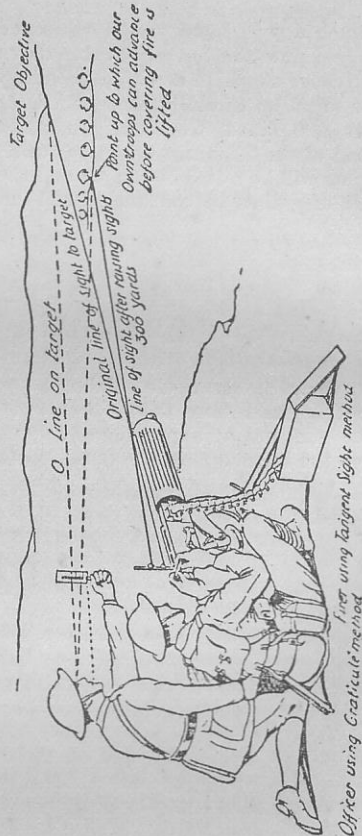


FIG. 37.

3. Method III. *Tangent sight method.*

This is a method to be used when, owing to casualty or other reason, no fire controller is available. It is a simple means whereby the men actually firing the guns can ensure the safety of the troops fired over. It will only be employed when no higher control is possible.

Given the range to the target it is necessary to ascertain up to what limit the infantry can advance before considerations of clearance render an increase of elevation necessary. In any case over-head fire must not be applied when our own troops are more than 2,000 yards from the gun.

To ascertain the limit of advance before elevation is increased, the firer, having laid on the target with the correct range on his sights, will raise his sights 300 yards, and, *without altering his elevating wheel*, see at what point his new line of sight cuts the ground. This point marks the position up to which our own troops can advance with safety so long as fire is being directed on to the target. The firer will use this point as an aiming mark on which to check his aim when firing, the tangent sight being set to the range to the target plus 300 yards (Fig. 37).

4. When the advancing troops have reached the position as found by either of the above methods, the guns will be elevated so as to bring fire to bear on ground in rear of the objective, with the object of harassing hostile reinforcements, whilst still producing moral effect upon the hostile troops in the objective.

To do this, the gunners will first add another 200 yards to the range at which their sights have been set (*i.e.*, 500 yards above the range to the target), and then relay on the objective and continue firing. This will cause the shots to fall in rear of the objective, with ample clearance over the attacking troops as they advance up to it. At this stage the tangent sight reading must never be less than 1,300 yards. If the addition of the extra 200 yards brings the tangent sight to less than 1,300 yards it must be raised to 1,300 yards

in order to ensure ample safety at close ranges. Fire will cease when the attacking troops pass the objective.

Example.—Range to target, 700 yards (Fig. 38).

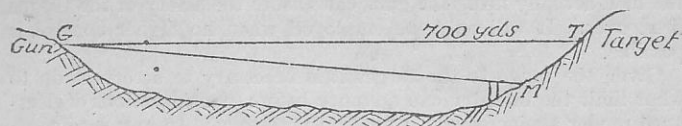


Fig. 38.

Lay on the target with 700 yards on the sights.

Alter tangent sight to 1,000 yards (*i.e.*, 300 yards higher), use the point M thus found, as aiming mark.

Fire until the attacking troops touch the line G.M.

Then cease fire, and set sights at 1,300 yards.

Aim at the target, and continue firing until the advancing troops pass T. Then cease fire.

5. In flat country, or in cases where the gun, target and our own troops all lie on the same plane (not necessarily horizontal), it will not be possible to obtain safety angles. The following procedure may then be adopted—

- i. Take range to target.
- ii. From table given below, ascertain safety zone for range to target.
- iii. With range-finder identify limits of safety zone on ground.
- iv. Order guns to lay on target with correct range on sights, allowing for atmospheric conditions.
- v. Open fire when our own troops reach the near limit of safety zone.
- vi. Cease fire when they reach the far limit, or raise sights 500 yards and relay on target if our troops are not advancing beyond it.

Range to Target.

Safety Zone.

1,300 yards	...	...	500 to 700 yards from gun.
1,400 "	...	...	400 to 900 " "
1,500 "	...	...	400 to 1,000 " "
1,600 "	...	...	300 to 1,100 " "
1,700 "	...	...	300 to 1,200 " "
1,800 "	...	...	200 to 1,300 " "
1,900 "	...	...	200 to 1,500 " "
2,000 "	...	...	200 to 1,600 " "
2,100 "	...	...	200 to 1,700 " "
2,200 "	...	...	200 to 1,800 " "
2,300 "	...	...	200 to 1,900 " "
2,400 yards and over	...	...	100 to 2,000 " "

6. *Conclusion.*—In the absence of factors which obstruct the field of view (mist, smoke screens, the smoke and dust caused by artillery, &c.), the foregoing methods of direct overhead fire are technically reliable. But because one or other of these factors either is or may be present, arrangements for indirect fire should be made as stated in Sec. 116, 3, and they should be of the following nature—

Once the gun has been laid on the target, an auxiliary aiming mark should be put out for the purpose of maintaining elevation and direction, and the maximum time during which the advance can be supported should be obtained either by estimating the rate of advance or by obtaining it from the artillery time-table. Thus, the point up to which the attacking troops can advance with safety being known, it can be decided how long fire may safely be directed on the target.

CHAPTER XI.

INDIRECT FIRE.

63. *Introduction.*

1. As has already been pointed out, the normal method of engaging a target is by direct fire. Cases will, however, frequently arise in which this is impossible or inadvisable. The method then employed is that of indirect fire, *i.e.*, the direction of fire on to a target which is invisible to the firer. It is carried out by any means other than that of laying the gun on the target over the sights.

Efforts should always be made to obtain observation of fire, which largely increases the accuracy and value of the fire.

2. Indirect fire is always carried out at medium or long ranges and is almost invariably overhead fire. It follows, therefore, that considerable volume of fire will be required, entailing the use of at least four guns (*i.e.*, the section) working under control.

Note.—In cases where the fire is not overhead but is carried out directly to a flank of our own troops, the rules for flanking fire given in Sec. 53 must be observed.

3. Indirect fire may be employed for any of the following reasons:

- i. When no ground can be reached from which direct fire can be brought to bear on the target.
- ii. When to employ the number of guns necessary to give and maintain the requisite support, direct fire would be inadvisable owing to the great difficulty of obtaining the

necessary concealment of the guns, chain of supply, &c., essential to enable them to continue in action under hostile fire.

iii. The fire of guns placed in rearward positions, to give depth to the defence, may be required for the support of troops in the forward area.

4. When siting guns for indirect fire careful consideration must also be given to the selection of a point from which control can be exercised, observation of fire obtained and the movements of our own and hostile troops observed by the machine gun commander. If this can be done the accuracy of the fire will be equal to that of direct observed fire at equivalent ranges, but the time taken to open fire will be longer.

5. The application of indirect fire with accuracy and rapidity entails a high standard of professional efficiency on the part of the officer. He must have a thorough knowledge of—

- (a) Maps.
- (b) The compass and its "characteristics."
- (c) The tables and graphs which give—
 - i. Tangent angles and angles of descent.
 - ii. Dimensions of cones and beaten zones.
 - iii. Methods of determining the angle of sight (*see* V.I. formula, Sec. 65) and the quadrant angle.
 - iv. Methods of determining clearances.
 - v. Allowances for atmospheric conditions.
- (d) Methods of laying and fire control.
- (e) The technical equipment in use.
- (f) Probable errors.
- (g) The possibilities and limitations of the machine gun.

6. It must be clearly realised that, except where accurate observation can be obtained, effective fire can seldom be obtained on a
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point target by means of indirect fire by merely laying all the guns employed on to that point.

The object must be to engage an area in which such a target is known to lie. The greater the care expended and accuracy obtained in the direction of fire, the smaller can be this area, and consequently the more effective the fire.

In such a case, it will therefore usually be necessary to traverse and search to a limited extent.

Unless the officer controlling the fire has an accurate knowledge of his probable errors both in direction and elevation, he may either—

- (a) By engaging an area unnecessarily large (in order to obtain fire effect on the target) obtain a very small material result; or,
- (b) By engaging an area too small, miss the target altogether.

In practice a balance has to be struck between these two limits, according to the knowledge and judgment of the officer controlling the fire.

Indirect fire may be carried out either—

- (a) By guns controlled singly, in which case the line of fire of a gun is laid out without reference to that of any other gun, or
- (b) By sections, platoons or larger units, in which case the lines of fire of all the guns are initially laid out in parallel directions. This enables the officer controlling to switch his guns in any desired direction or to distribute his fire laterally or in depth with ease and rapidity.

8. For the sake of simplicity indirect fire will be dealt with under the following headings:—

A.—Indirect fire of guns controlled singly.

B.—Indirect fire of guns controlled in sections or larger units.

In either case direction and elevation will be obtained by the use of:—

- i. Compass and angle of sight instrument, or a director, or
- ii. A map, which must be of a scale not less than 1/20000 and contoured at a vertical interval of not more than 20 feet.

A.—INDIRECT FIRE OF GUNS CONTROLLED SINGLY.

64. *Direction and elevation obtained by compass and angle of sight instrument, or a director.*

T.O.G. Method.

This is the method of carrying out indirect fire without large scale maps.

1. *Short Base.*

The gun is sited close in rear of the crest or other feature which conceals it from enemy view, and an observation post is selected, if possible slightly forward and to a flank of the gun. From this post it must be possible:—

To view all ground on which it may be necessary to fire, and,

To view and communicate rapidly with the gun.

The method by which direction and elevation are obtained is as follows:—

i. *To obtain direction. (See Fig. 39.)*

(a) Take the range OT.

(b) Measure the angle TOG.

(c) Pace OG and convert this length to a true base OG'.
(See conversion scale, Appendix V.)

(d) From OG' and the range OT, find the angle OTG.

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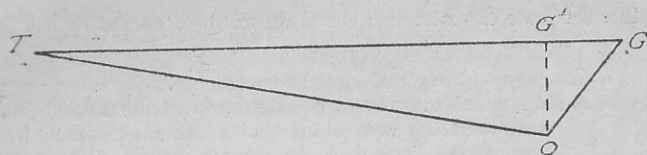


FIG. 39.

(e) Then angle $OGT = 180 - (TOG + OTG)$.

The gun is first laid on the O.P. and is then swung off through the angle OGT . It is now laid on the target.

Note.—*Effect of atmospheric conditions on direction.*—After the gun has been laid for direction, it is necessary to make the correction for wind. To find the allowance, see graph of climatic allowances, Appendix IV.

This allowance is put on the gun by using the bar foresight (see Sec. 81).

ii. *To obtain elevation.*

(a) Knowing range OT , GT can be estimated.

(b) Take angle of sight from O to T .

(c) Add this to or subtract it from the tangent angle for the range GT . This is the quadrant angle for the gun.

Note.—The case may arise in which the position of the O.P. is considerably higher than that of the gun, although the distance from gun to O.P. may be quite short. It will then be necessary to make allowance for the fact that the angle of sight from gun to target is not approximately equal to that from the O.P. to the target. This is most easily effected by taking the angle of sight from the O.P.

to the gun, multiplying this angle by the ranges $\frac{OG}{OT}$ and adding the resulting angle to the QA already calculated

iii. *To put elevation on the gun.*—Elevation should be put on with the Vickers Gun Clinometer, as follows:—

Set the clinometer to the required reading.

Open the rear cover of the gun and fit the clinometer accurately on top of the side plates of the breech casing, the arrow-head on the clinometer pointing towards the muzzle of the gun.

Elevate the gun by turning the elevating wheel until the bubble is central.

The required elevation will now be on the gun.

To facilitate the maintenance of elevation, the tangent sight slide should now be adjusted so as to bring the line of sight on to any suitable auxiliary aiming mark, "holding" pressure being maintained throughout.

Note 1.—*Before placing elevation on the gun the correction for atmospheric influences must first be made and the correction added to or subtracted from the Q.A., according as the correction is positive or negative.* (See graph of climatic allowances, Appendix IV.)

Note 2.—Clinometers should be frequently tested by any of the methods given in Appendix VI.

Elevation can be maintained by using the clinometer during intervals of firing to check the elevation on the gun, and by ensuring that the line of sight remains on the auxiliary aiming mark, and, if it is shaken off, re-laying by means of the elevating wheel.

2. Long Base.

This method is much slower in application, and will only be used when demanded by the tactical situation, and the necessary time is available.

The method is as follows:—

i. *To obtain direction.*

(a) Take the ranges OT and OG .

(b) Measure the angle TOG .

- (c) Draw to any convenient scale lines representing these ranges and containing between them the angle TOG, and complete the triangle.
- (d) GT will then represent to the scale of the drawing the range GT, and the angle OGT will be the angle through which the gun must be swung after being laid on the O.P. in order that it may be laid on the target.
- ii. *To obtain elevation.*
- (a) Take angle of sight from O to T and from O to G.
- (b) Knowing ranges OT and GT, work out heights of T and G with respect to O.
- (c) Find height of T with respect to G.
- (d) Knowing range GT, find quadrant angle for the gun.

65. *Direction and elevation obtained from the map.*

1. *To obtain direction.*

Method 1. By map and compass.—i. *The position of the gun on the ground must be accurately fixed on the map.*

This is done either—

- (a) By comparing the detail on the ground with the detail on the map; or if this is not possible,
- (b) By resection.

Where time permits greater accuracy is ensured by employing one method and checking with another.

It may be possible to obtain the aid of a Field Survey Company where a very accurate location is necessary.

The use of oblique aeroplane photographs has been found helpful when moving guns forward to positions already sited on ground previously occupied by the enemy.

ii. *The magnetic bearing of the target from the gun must now be found.*

To do this—

- (a) Draw a line on the map from the gun position to the target.
- (b) Using the protractor, measure the bearing this line makes with any north and south line. This is the true bearing of the target from the gun.
- (c) Add the magnetic variation of the compass from the north and south lines. The result is the magnetic bearing of the target from the gun.

Note 1.—(c) Applies only to places where the magnetic variation is west.

If the variation is east, subtract instead of add.

Note 2.—The variation of the compass must be determined for each compass for the particular locality, and should be constantly checked.

iii. *To lay the gun on the magnetic bearing so obtained.*

Place a post (not more than 6 inches high) in the gun position and place the compass on the top of the post. Rotate the compass until the card reads the required bearing.

Align an aiming post on this bearing, using the hair line on the compass. Place the gun with the centre of the cross at the bottom of the socket immediately over the post, and lay on the aiming post.

Method 2. By map and reference object (Fig. 40).—i. *The position of the gun on the ground must first be accurately fixed on the map.*

ii. A reference object, which is both marked on the map and visible from the gun, is next selected. A line is drawn on the map—

- (a) From the gun position to the target—G.T.; and
- (b) From the gun position to the R.O.—G.R.

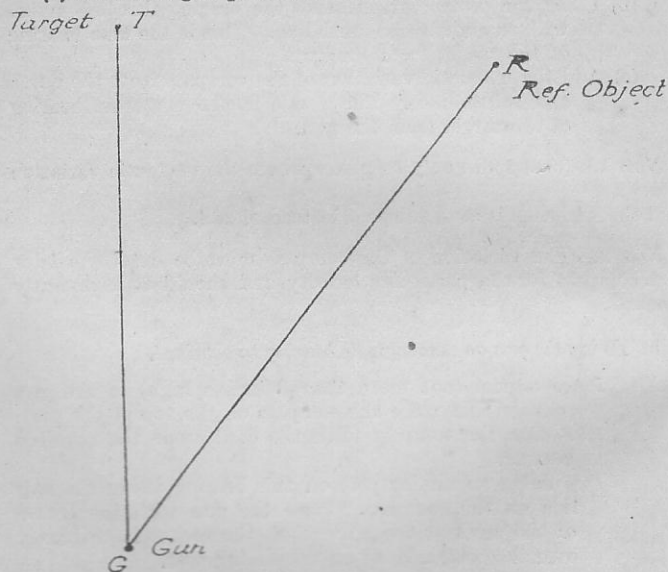


FIG. 40.

The angle TGR is now measured with a protractor. The firer lays on the R.O. and taps off the angle TGR, and an aiming post is put out in the direction obtained. The gun is now aligned on the target.

The angle TGR may be measured with a protractor without drawing any lines—but these are an aid to accuracy.

Where the position of the gun can be found from the detail on the ground, all errors arising from the use of the compass are avoided.

Method 3. By map, reference object, and compass.—A modification of Method 2 is necessary where no suitable reference object exists which is marked on the map and is visible from the gun.

Select a reference object on the ground, or, if necessary, place one out. Take the compass bearing from the gun position to the reference object.

Find from the map the bearing on which it is required to fire the gun and convert this to a compass bearing.

Find the difference between these bearings and lay off, from the reference object, the angle thus obtained.

2. To obtain elevation (Figs. 41 and 42).

- i. On the map, measure range from the gun to the target and note—

- (a) The gun contour
- (b) The target contour.

The difference between the gun contour and the target contour is the vertical interval (V.I.).

- ii. The quadrant angle is now found by the formula—

$$Q.A. = T.A. \pm S. \quad (\text{See Note to Sec. 48, 16.})$$

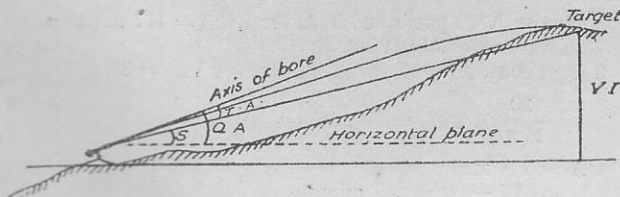


FIG. 41.

iii. To obtain the angle of sight use the formula—

$$\text{Angle of sight in minutes} = S = \frac{\text{V.I.}}{\text{H.E.}} \times 3400,$$

where V.I. = Vertical interval (or base),
H.E. = Range,
and both are measured in the same unit.

Note.—The V.I. graph (Appendix V) is compiled from the above formula.

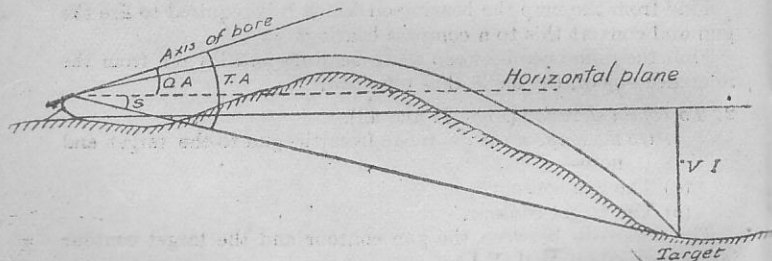


FIG. 42.

Example—

Range = 1,700 yards and T.A. for 1,700 = 177 minutes.

Gun contour = 20 yards.

Target contour = 50 yards. Therefore V.I. = 30.

$$S = \frac{30}{1700} \times 3400 = 60 \text{ minutes}$$

$$\begin{aligned} \text{QA} &= \text{TA} \pm S \\ &= 177 + 60 = 237 \text{ minutes} \end{aligned}$$

or again if range = 1,700 yards,

Gun contour = 50 yards,

Target contour = 20 yards,

$$S = \frac{30}{1700} \times 3400 = 60 \text{ minutes.}$$

$$\begin{aligned} \text{QA} &= \text{TA} - S \\ &= 177 \text{ minutes} - 60 \text{ minutes.} \\ &= 117 \text{ minutes} \end{aligned}$$

The trajectory graph shown in Appendix II, allows the quadrant angle to be read off without calculation of the angle of sight.

66. Clearing the obstruction.

1. In all cases where an obstruction exists between the gun and the target, it is necessary to ensure that the shots will clear the obstruction before opening fire.

To do this—

- i. After the gun has been laid for direction and elevation, adjust the tangent sight slide to read the range from the gun to the top of the obstruction. If on looking along the sights the obstruction is not visible, the shots will clear.

Note.—If the line of sight only just clears the obstruction, the lower half of the cone will strike the obstruction

- ii. If the distance to the obstruction is under 100 yards put the sights at zero (the gun being already laid for

direction and elevation); if, on looking along the sights the obstruction is not visible, the shots will clear.

2. If the obstruction is invisible (such as the summit of a hill hidden by a false crest) neither of the methods given above will apply, and the clearance must be found by the method of substituting "obstruction" for "our own troops" (see Sec. 77). The clearance must be at least equal to the height of the cone.

67. *Maintaining laying.*

1. After a gun has been laid for direction and elevation by any of the means described in Secs 64 and 65, an aiming post is put out in order to maintain direction and elevation. The tangent sight slide is run up until the sights are aligned on the bullseye on the aiming post, and the laying is maintained by relaying on the bullseye between bursts. In addition, the elevation should be frequently checked by the clinometer.

2. Inaccurate laying on the auxiliary aiming mark can only be avoided by training the personnel. Too much stress cannot be laid on this part of the machine gunner's training, as failure to realise the importance of accurate aiming may lead to fire becoming dangerous to our own troops, and a consequent loss of confidence by the infantry.

Note.—Where no form of artificial auxiliary aiming mark is available, some natural object on the ground may be selected. This should only be regarded as a makeshift, and not taught as a general practice.

B.—INDIRECT FIRE OF GUNS CONTROLLED IN PLATOONS OR SECTIONS.

68. *General remarks.*

1. The principles and methods laid down in the following sections apply to any number of machine guns that may be grouped together as a fire unit under the control of one officer.

The section—four guns—is referred to throughout for reasons of brevity and simplicity.

It must be realised that the figures in the following sections are not drawn to scale.

2. Although organized fire from a large number of machine guns can be carried out by controlling the fire of each gun separately, experience has shown that the method lacks flexibility, that calculations are laborious and control difficult. By the aid of simple calculations the organized fire of sections or larger units is made not only flexible but easy of control, and has proved of great value in supporting infantry in the attack.

3. In laying out the lines of fire, the position of one gun is fixed on the map as accurately as possible; this gun is known as the directing gun and is generally a flank gun of the section.

To provide the officer controlling the fire with a basis from which to direct the fire of his guns in any required direction, all guns are laid, in the first instance, on "zero" lines from which they can be swung through the angle necessary to direct their fire on to any target within range.

69. *Definitions.*

1. *Zero lines* for a section are parallel auxiliary lines of sight on to auxiliary aiming marks laid out in any convenient direction.

They form the basic lines from which the lines of fire of the guns can be directed on to any given target

2. *Angle of switch.*—The angle through which a section must be swung from its zero line in order that the line of fire of the directing gun may be brought on to the particular part of the target which it is first required to engage.

3. *Angle of distribution.*—The angle through which the gun next to the directing gun must be swung away from the latter in order that its line of fire may be directed on to the particular part of the target which it is first required to engage.

4. *Angle of deviation from zero.*—The total angle through which any gun of a section must be swung from its zero line in order that its line of fire may be directed on to the particular part of the target which it is first required to engage.

5. *Parallel lines of fire.*—When the lines of fire of all the guns of a section are parallel, the latter is said to be laid on parallel lines of fire.

6. *Frontage of a section.*—Is the perpendicular distance between the parallel lines for the flank guns.

This will only be equal to the actual distance between the flank guns when the line of fire of the directing gun is at right angles to the line of guns. (Fig. 43.)

The error arising from considering the section frontage as equal to the distance between flank guns may always be neglected when the angle D41 is between 110 deg. and 70 deg.

In other cases, greater accuracy will result if the frontage 1F is used rather than the distance between flank guns 1-4.

To obtain 1F, measure it on the map, or calculate from the conversion scale (Appendix V).

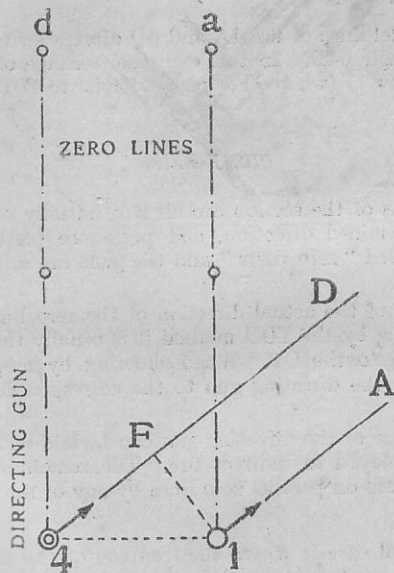


Fig. 43.

The figure shows—

- i. Zero lines of flank guns of a section ; 1a and 4d. In this case the frontage of the section = 1-4, as the angle $d4l = 90$ deg.
- ii. Parallel lines of fire 1A and 4D after a switch through the angle $d4D$. In this case the frontage of the section is now 1F (where 1F is perpendicular to 4D) and NOT 1-4.

70. Zero lines.

1. The guns of the section are all laid initially on parallel lines in a predetermined direction, and posts are placed in position. These are called "zero posts" and the guns are said to be laid on "zero lines."

The choice of the actual direction of the zero lines is arbitrary. When shooting by the TOG method it is usually the line from the directing gun to the OP. When shooting by map it is usually the line from the directing gun to the corresponding flank of the target.

The zero line of the directing gun can be laid out by any of the methods employed in indirect fire. The remainder of the guns can then be laid on parallel zero lines by any of the methods given in Sec. 75.

2. The ideal case is where the frontage of the target as viewed from the gun position is equal to the frontage of the section, and where the zero line of the directing gun is laid on the corresponding end of the target. (Fig. 44.)

Each gun being laid on a line of fire which is parallel to the zero line of the directing gun, it follows that No. 1 gun will be laid on the

right end of the target, and the other guns on the particular portions of the target they have, respectively, to engage, as shown in Fig. 44.

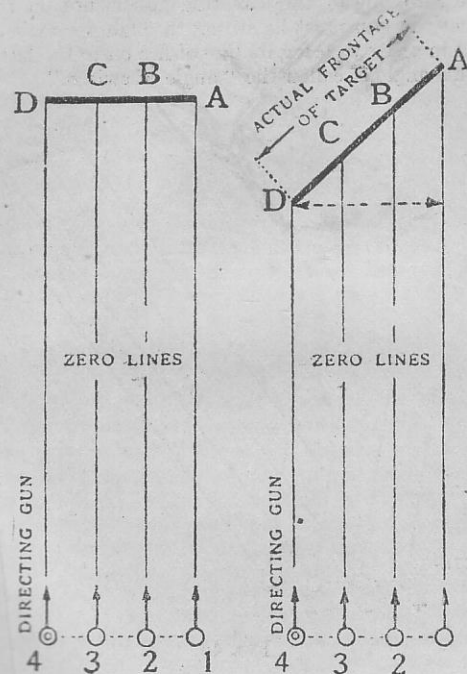


FIG. 44.

Ideal case—Target frontage = section frontage.
Zero line of directing gun on the left end of the target.

71. Parallel lines of fire and angle of switch.

1. If the zero line of the directing gun is not on the left end of the target the gun must be swung through a certain angle from its zero line in order to bring its line of fire on to the left end of the target. This angle is called the "angle of switch."

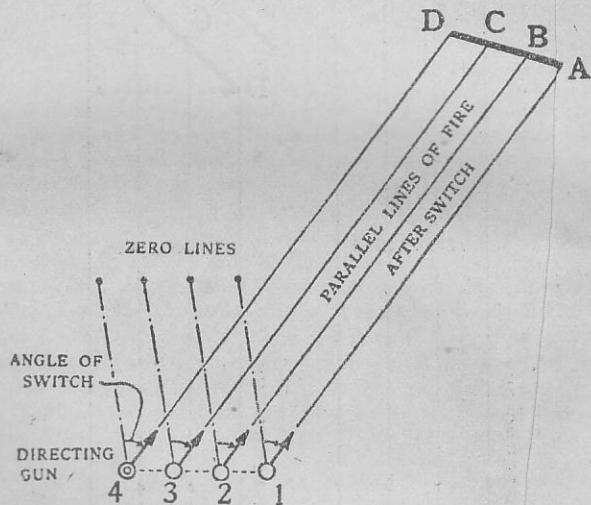


FIG. 45.

2. If all the guns are moved through the same "angle of switch" from their respective zero lines, the resulting lines of fire will still

be parallel (Fig. 45), and the section is said to be on "parallel lines of fire" (as distinct from parallel ZERO lines).

The angle of switch is entered up in the platoon or section chart (Appendix VIII).

This figure shows the guns of a section—

- i. On their zero lines.
- ii. On parallel lines of fire after moving through the angle of switch thereby bringing the line of fire of the directing gun on to the left end of the target.

NOTE.—The frontage of the target *as viewed from the gun position* is again shown equal to the frontage of the section and each gun is laid on its particular part of the target after switching.

72. Distribution of fire.

1. When the frontage of the target *as viewed from the gun position* EXCEEDS the frontage of the section, it becomes necessary to open out the parallel lines of fire which have been shown hitherto, as otherwise, only a portion of the target would be engaged. (Fig. 46.)

This process of "opening out" is called "distribution" and the angular difference between the lines of fire of any two adjacent guns after distribution is called the "angle of distribution." In Fig. 47 the angle c3C is the angle of distribution.

2. To obtain the angle of distribution it is necessary first to find the angle between the lines joining the flank guns of the section to the corresponding flanks of the target, i.e., the angle between the lines 1A and 4D (Fig. 47).

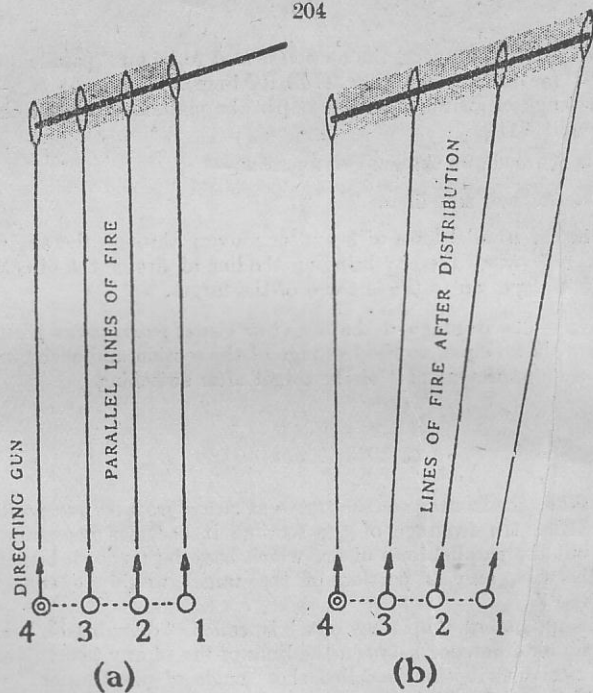


FIG. 46.

(a) Shows a section laid on parallel lines where the frontage of the target as viewed from the gun position, exceeds that of the section. The directing gun is laid on the left end of the target; only a portion of the target is engaged.

(b) Shows how the whole of the target may be engaged by opening out the lines of fire from the original parallel lines.

There are several methods of finding the angle of distribution, as follows:—

First method.—When using the TOG.

Case I.—*Short Base.*

- i. Find the angle subtended by the target at the O.P.
- ii. From this angle subtract one degree.
- iii. Divide the remainder by the number of gun intervals.
The result is the angle of distribution.

Case II.—*Long Base.*

- (a) Draw the triangle TOG by the method described in Sec. 64, 2.
- (b) Using the other end of the target as the point T, draw a second triangle having a common base OG with the first.
- (c) Measure the angle between the two lines joining G to the extremities of the target.
- (d) From this angle subtract one degree and divide the remainder by the number of gun intervals.
The result is the angle of distribution.

Second method (Fig. 47).—Draw 1a parallel to 4D.

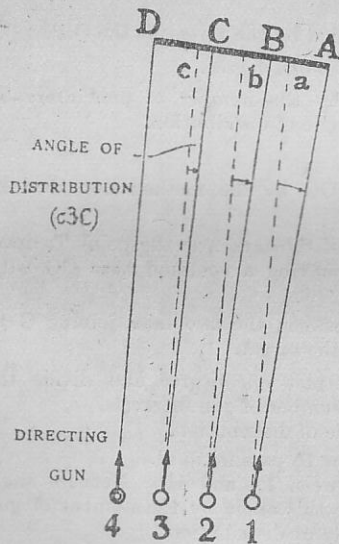
Then angle Ala = angle between 1A and 4D. Measure angle Ala with a protractor. Divide this angle by the number of gun intervals: the result is the angle of distribution.

Third method (Fig. 47 (a)).—Case I.—Where the angle $AD4$ is between 80 deg. and 100 deg.

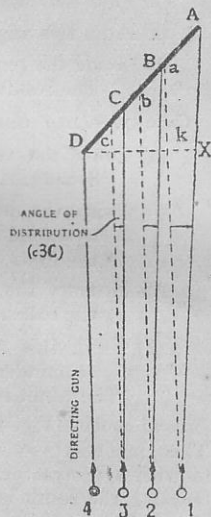
Procedure.—

- (a) Subtract the frontage of the section from the frontage of the target, thus obtaining the length Aa.
- (b) Find what angle this length (Aa) subtends at the range 4D.

- (c) Divide this angle* by the number of gun intervals. The resultant angle (c3C) is the angle of distribution for the section, and should be taken to the nearest 10 minutes.



(a) FIG. 47.



(b)

* The quickest way of finding this angle is by means of the V.I. graph given in Appendix V.

If no graph is available, the "angle of sight" formula may be used in cases where the angle a1A does NOT exceed 10 deg.

Case II (Fig. 47 (b)).—Where the angle $\angle AD4$ is less than 80 deg. or more than 100 deg.

Procedure—

- (A) i. On the map draw DX at right angles to 4D. (This is called the "working base.")
- ii. Subtract the frontage of the section from the length of the working base, thus obtaining the length of kX.
- iii. Find what angle* this length kX subtends at the range 4D.
- iv. Divide this angle by the number of gun intervals. The resultant angle is the angle of distribution for the section (c3C), and measurements should be taken to the nearest 10 minutes.
- (B). Use the conversion scale shown in Appendix V to find the length of the working base; then proceed as in (A) (ii.), (iii.), and (iv.).

3. It can easily be seen that the angle $\angle a1A$ is three times the angle of distribution $\angle c3C$, and that the angle $\angle b2B$ is twice the angle of distribution $\angle c3C$.

It follows, therefore, that in this particular case of a section when distribution is ordered, the directing gun remains on its line; No. 3 gun swings through the angle of distribution, away from the directing gun; No. 2 gun through *twice* the angle of distribution and No. 1 gun through *three times* the angle of distribution.

4. The actual order in the field by which distribution is effected may be conveyed either by a written chart or message, or by the

* The quickest way of finding this angle is by means of the graph given in Appendix V.

If no graph is available, "the angle of sight" formula may be used in cases where the angle $\angle a1A$ does NOT exceed 10°

passing of verbal orders. These methods are dealt with under "section gun drill" (Sec. 21). The angle of distribution is entered up in the sub-group chart.

5. In Case II, an appreciable error would arise if the same procedure was adopted as for Case I, owing to the foreshortening of the target as viewed from the section.

6. It is not essential that the line of gun positions as laid out on the actual ground should correspond exactly with that line as drawn on the map for the purpose of calculating the angle of distribution. Even a comparatively large difference in the direction of these lines will have no appreciable effect on the value of the angle of distribution.

NOTE.—The converse of "distribution" is "concentration," which would appear to be necessary in the case where the frontage of the target as viewed from the gun position is less than that of the section. As, however, one of the principles of machine gunnery is to engage an area in which the target is known to lie, rather than to attempt to direct all the fire on to a point (Sec. 63, 6), "concentration," need not be considered in relation to machine gun fire.

Since the interval between the guns of a section or platoon will seldom be more than 15 yards, it will be sufficient to engage the target on parallel lines of fire, traversing being employed to ensure overlapping of beaten zones.

In the case of targets which are not directly in front of the gun position, it is obvious that the more nearly the lines of fire approach to the line of the gun positions, the closer together will the lines of fire become. (Fig. 48.)

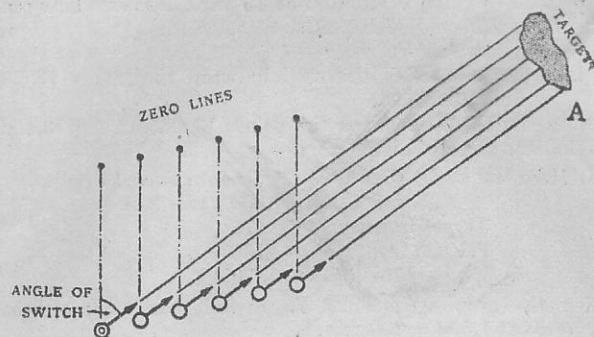


FIG. 48.

Example.

8. An example of distribution is shown on the map in Fig. 49.

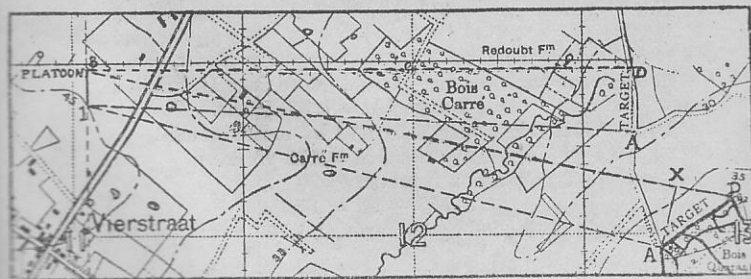


FIG. 49. (Scale 1/40,000.)

A platoon (8 guns) is situated at 15 yard intervals between the points 11.b.09.75 and 11.b.09.97.

Two targets are shown, viz. :—

- i. A portion AD of the road between the points 13.a.30.58 and 13.a.28.93.
- ii. A trench AD between the points 13.c.45.92 and 13.a.89.19. To find the angle of distribution—

- i. Here the angle 8DA is 93 deg., hence Case I applies

Range 8 D = 1,600 yards.

Target frontage = 175 "

Platoon frontage = 105 "

175—105 = 70 "

Using the graph, Appendix V, we find the angle subtended by 70 yards at 1,600 = 150 min.

Dividing this by the number of gun intervals (7) gives the angle of distribution = 20 min. (to nearest 10 min.).

When distribution is ordered :—

No. 8 gun (directing) remains on its line 8D.

No. 7 gun distributes 20 min. away from the directing gun

No. 6 " " 40 " " " "

No. 5 " " 1 deg. " " "

and so on.

- ii. Here the angle 8DA is 44 deg., hence Case II, applies.

Range IA = 1,750 yards.

Draw AX at right angles to IA : by measurement.

AX = 175 yards.

True platoon frontage = 90 "

175 — 90 = 85 "

The angle subtended by 85 yards at 1,750 yards = 170 min.

Angle of distribution = $\frac{170}{7} = 24 \text{ min.} = 20 \text{ min. (to nearest 10 min.)}$

73. Angle of deviation from zero (Fig. 50).

1. This is found by combining the angle of switch with the angle of distribution, or the necessary multiple of the latter. It will be noticed that the angle of deviation from zero of the directing gun equals the angle of switch.

2. When shooting by the map the angle of deviation from zero for each gun is entered on the platoon or section chart.

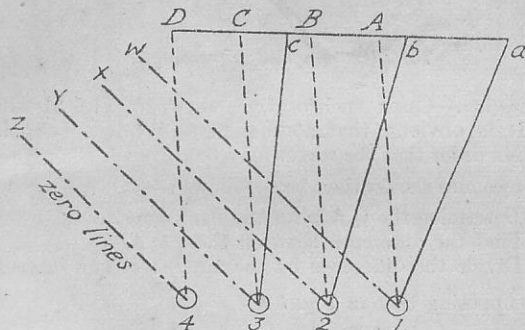


FIG. 50.

Angle Z4D = Angle of switch.

" C3c = " distribution.

" c3Y = " deviation from zero No. 3 gun.

" b2X = " " " No. 2 gun.

" a1W = " " " No. 1 gun.

Example.—A section in position : the angle of switch for a certain target is 55 deg. right : the angle of distribution ordered is

30 min. What is the angle of deviation from zero for No. 1 gun (No. 4 gun directing) ?

No. 1 gun will swing to the right first through the angle of switch = 55 deg. and then (still in the same direction) through three times the angle of distribution = $3 \times \frac{1}{3}$ deg. = $1\frac{1}{3}$ deg. : the angle of deviation from zero is therefore $56\frac{1}{3}$ deg. R. for this particular gun and target.

Note that if the switch had been 55 deg. *left*, the angle of deviation from zero would have been $53\frac{1}{3}$ deg. L.

74. Elevation and traversing.

1. *Elevation.*—Cases such as that shown in Fig. 51 will often arise. It is obvious that a different Q.A. must be placed on each gun in order that the target may be engaged.

The procedure should then be as follows :—

- i Determine the Q.A.'s for the flank guns.
- ii. Find the difference between these Q.A.'s.
- iii. Divide the difference by the number of gun intervals.

Thus : supposing that in Fig. 51—

Q.A. for No. 1 gun = 4 deg.

" " 4 " = 5 "

Difference = 1 "

Dividing by 3 gives $20'$

Then Q.A. for No. 2 gun = $4^\circ 20'$

" " " 3 " = $4^\circ 40'$

Order elevation 4 deg. add 20 min. (assuming the right gun to be the directing gun). Searching will be employed when the nature of the target demands it.

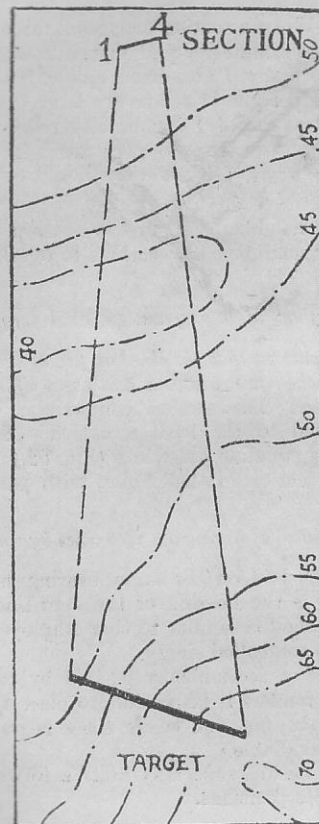


FIG. 51.

2. *Traversing*.—When a section engages a target, the fire of each gun is laid at approximately equal intervals along it. Each gun should traverse, normally, 1 deg. either side of its line of fire, except where the frontage per gun is relatively large, *i.e.*, over 50 yards per gun, when a traverse of 1 deg. on either side of the line of fire is not sufficient to ensure that no gaps are left. In this case a traverse of *twice the angle of distribution* should be ordered.

Traversing prevents gaps being formed by causing—

- (a) The fire of neighbouring guns to overlap.
- (b) The fire of neighbouring sections to overlap.

75. Method of laying out parallel zero lines.

1. It is most important that the lines of fire of the guns of a section should be parallel when first laid out and every effort should be made to attain this object. The section commander must choose the method most suited to the local situation. The gun intervals should be as nearly equal as possible. (Fig. 52.)

Fig. 52 shows a section in shell holes, with parallel zero lines.

A.—Method of laying out zero lines by compass.

- i. Each gun is laid on the same bearing by compass; this bearing is the bearing of the zero line for the section. The method is similar to that employed in indirect fire of guns controlled singly.
- ii. The lines of a section may be laid by compass when the ground renders it impossible to place the guns approximately in line, and where there is no reference object (R.O.) available.

This often occurs, especially after a forward move to new shell hole positions.

ZERO LINES

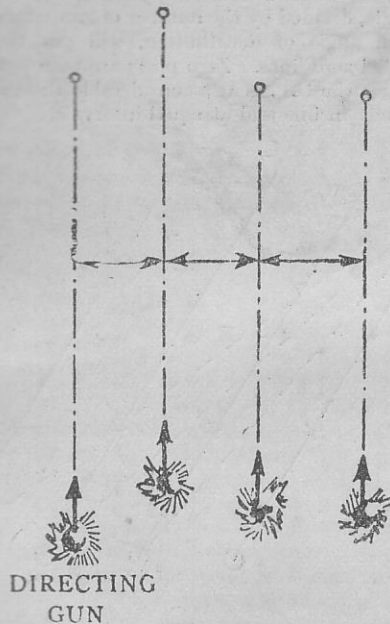


FIG. 52.

B.—Method of laying out zero lines by the use of a director or compass.

The O.P. should be visible, if possible, to all the guns—

- i. Immediately the guns have been mounted they will be laid on the O.P.

- ii. The controlling officer will then measure, by director or compass, the angle subtended by the section at the O.P.
- iii. This angle, divided by the number of gun intervals and used as an angle of distribution, will put the section on parallel zero lines. Zero posts are then put out.

NOTE.—Unless the O.P. is at a considerable distance, the guns must be accurately in line and at equal intervals.

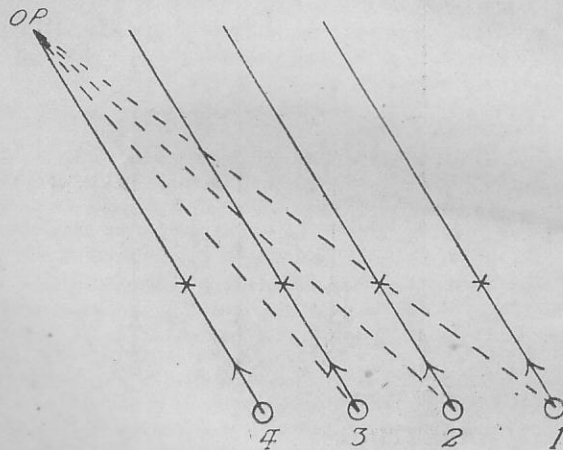


FIG. 53.

iv. Fig. 53 shows the section—

a) On the O.P.

(b) On its parallel zero lines.

C.—Method of laying out zero lines by the use of an R.O.

- i. The flank guns are mounted first and laid on each other.
- ii. All guns are then laid on the R.O.
- iii. The flank guns note, by their direction dials, the angles they have swung through.
- iv. These angles are added together and subtracted from 180. The remainder is the angle subtended at the R.O. by the section.
- v. Divide this angle by the number of gun intervals and use the result as an angle of distribution. The guns are then on parallel lines.
- vi. Fig. 54 shows the section—
 - (a) On the R.O.
 - (b) On parallel lines.
- vii. If these lines are not in the required direction, all guns can be switched through the same angle (R4d) to bring the lines on to the bearing desired before zero posts are put out.

NOTE 1.—Should the R.O. selected be beyond extreme range or directly to a flank of the guns, distribution is unnecessary as they will already be, for all practical purposes, parallel.

NOTE 2.—It may happen that no suitable R.O. exists which is marked on the map, but that there is some object which might be used on the ground. By taking a bearing with the compass on to this object, the angle through which the guns must be swung to bring them on to their zero lines can be obtained. The object can then be used as an R.O. to obtain parallelism as above.

NOTE 3.—The R.O. must be as far away as possible, and it is sufficient if the guns are approximately in line. If there is no suitable R.O., one can be put out in the line of the guns at a distance of at least 400 yards, if possible, and the guns should be accurately in line.

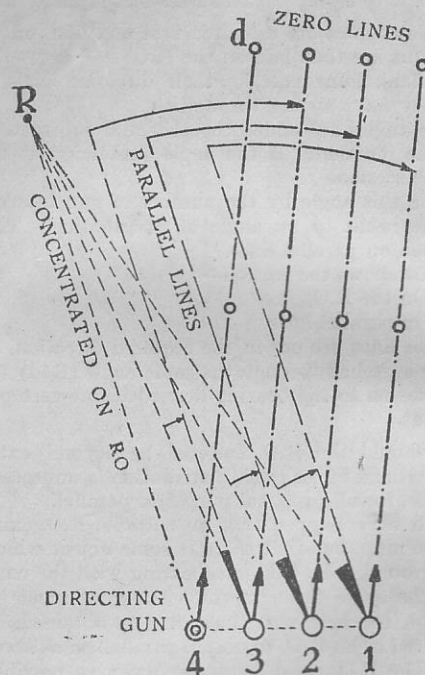


FIG. 54.

2. In all the preceding cases the bearing to the R.O. has been taken from the directing gun. It may happen, however, that the R.O. is invisible from one of the gun positions, or that a gun is out of line. In this case its line can be obtained—

i. By compass.

ii. By laying the gun on any gun which has obtained its zero line. This method is shown in Fig. 55.

The figure shows 3c, the zero line of a gun already obtained; it is required to lay the gun 2 on a parallel line.

The guns are laid first on each other; the angle c32 is then obtained by swinging No. 3 gun back to its zero line.

This angle is subtracted from 180 deg. and No. 2 gun is swung away from No. 3 gun through the angle thus obtained. It will then be on a line parallel to 3c.

Example.—The angle c32 is found to be 105 deg.; 180 deg. — 105 deg. = 75 deg. : No. 2 gun is laid on No. 3 and then swings through an angle of 75 deg. right.

(B 15591)q

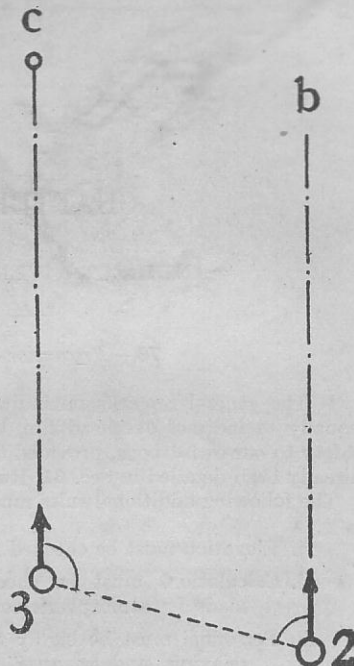


FIG. 55.

CHAPTER XII.

INDIRECT OVERHEAD FIRE.

76.—*Precautions necessary.*

1. The general remarks on indirect fire given in Sec. 63 apply equally to indirect overhead fire, which can be carried out with safety to our own troops, provided that the precautions which have already been detailed in Sec. 61, Rules i to v, are taken.

The following additional rules must also be observed :—

- i. Elevation must be checked frequently by the clinometer.
- ii. Calculations must be checked carefully and allowances made for atmospheric conditions.
- iii. Personnel must be highly trained in accurate aiming and relaying, and an auxiliary aiming mark must always be used.
- iv. The following minimum clearance of the centre of the cone above the heads of our own troops is required.

Range to our own troops.					Minimum clearance.	
					Yards.	Metres.
600 yards and under	...	...	...	...	11	10
700 yards	...	...	...	...	13	12
800	...	...	...	...	15	14
900	...	...	...	...	17	16
1,000	...	...	...	...	20	18
1,100	...	...	...	...	23	21
1,200	...	...	...	...	27	25
1,300	...	...	...	...	31	28
1,400	...	...	...	...	35	32
1,500	...	...	...	...	40	37
1,600	...	...	...	...	46	42
1,700	...	...	...	...	53	48
1,800	...	...	...	...	60	55
1,900	...	...	...	...	69	63
2,000	...	...	...	...	80	73

2. The clearance at any point over which fire is being directed is the vertical distance of the centre of the cone above that point.

NOTE.—The safety clearances are based on :—

- i. A possibility of 5 per cent. error in range.
- ii. A possibility of 10 per cent. error due to such causes as defective ammunition, &c.
- iii. A possible error of 40 min. due to wear of the tripod.

77. How to calculate safety clearances.

In order to find the clearance, *i.e.*, the height from the ground to the centre of the cone at any point in the line of fire, the following method can be used (Figs. 56, 57, 58 and 59) :—

Let gun contour	...	...	= A yards.
„ own troops contour	...	...	= B „
„ height of centre of cone,			
above or below the hori-			
zontal plane through the			
gun position, at the range			
to our own troops	...	...	= C „

Then clearance (yards) = $A - B \pm C$.

C must be added or subtracted according as the trajectory at the range to our own troops is above or below the horizontal plane through the gun position.

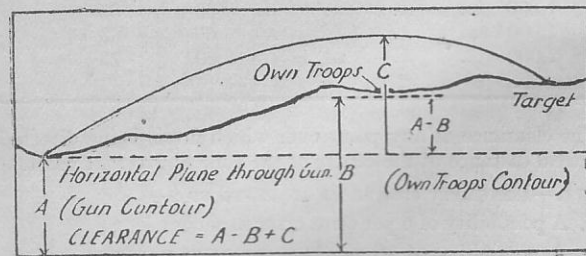


FIG. 56.

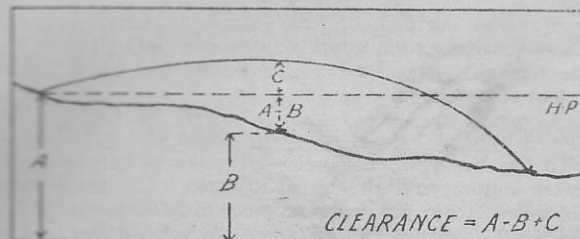


FIG. 57.

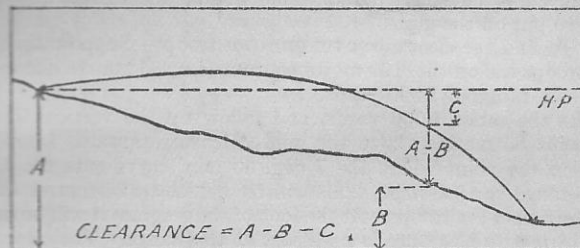


FIG. 58.

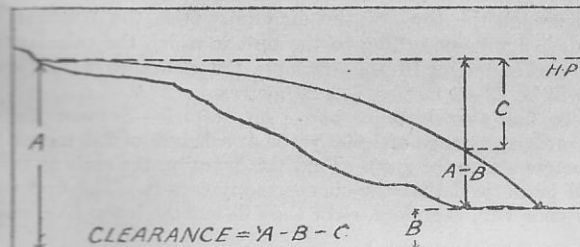


FIG. 59.

The quickest method of calculating quadrant angles and clearances above our own troops or obstacles is by means of the trajectory graph (Appendix II). The method of use is explained at the foot of the graph.

Example of use—

(a) To find the quadrant angle—Suppose the gun to be on a 105 metre contour, and the target to be on a 120 metre contour (*i.e.*, 15 metres above the gun) at a range of 2,500 yards.

Take the 2,500 range and follow up the vertical line to a point 15 metres above the gun level. It will be found that the 7 deg. 50 min. curve cuts this point. This will be the correct quadrant angle to put on the gun.

(b) To find the clearance over our own troops—Suppose that our own troops are on the 190 metre contour (*i.e.*, 85 metres above the gun) at a range of 1,000 yards.

Take the range 1,000 yards, and follow up the vertical line to the point 85 metres above the gun. Measure upwards from this point to the point where the 7 deg. 50 min. curve cuts the 1,000 yards range vertical line. This will be seen to be 23 metres above the position of the troops. At the foot of the diagram it will be noted that 18 metres clearance is necessary at this range. The clearance is, therefore, sufficient.

If it is desired to find the clearance of the lowest shot, subtract the figure at the top of the diagram. (Use the "metres" or "yards" figures according to the unit in which the calculation is being worked out). In this example the clearance of the lowest shot will be 23—3 metres, *i.e.*, 20 metres.

(c) To find the clearance above an obstacle—Suppose there is a hill crest at a range of 1,600 yards at a height of 239 metres (*i.e.*, 134 metres above the gun). Find this point on the scale as before. It will be noticed that the curve exactly cuts it. The upper half of the cone will, therefore, clear the hill but the lower half will hit

it. In order that the whole of the cone may clear the obstruction, the clearance must not be less than half the height of the cone at the distance from gun to top of the obstruction (*see* Column 4, Range Tables, Appendix I).

Notes.—The yard scales can be used in place of the metre scales in the case of maps contoured in yards, or where it is required to find the clearance in yards.

It will be found more easy to read the graph if a pin is stuck into the position of the target and that of the troops or obstruction when found.

The range corresponding to any given quadrant angle can be found by following the QA curve until it cuts the zero line, *e.g.*, range 2,500, target 15 metres above the gun, QA, is 7 deg. 50 min.; follow this curve along; it cuts the zero line at a range of 2,550 yards, which is the range corresponding to this angle.

78. Indirect overhead fire by TOG method.

1. When short base TOG method is employed, the method of ensuring the safety of our own troops is similar to that employed when firing direct. The officer at the O.P. uses graticules and keeps the troops fired over under careful observation.

2. When the long base TOG method is employed, if the troops to be fired over are stationary, the range and angle of sight to their position must be taken from the O.P. The height of our own troops relative to the O.P. can then be obtained. From this their height relative to the gun position can be calculated. The angle contained between the lines, gun position to O.P., and our own troops to O.P. must also be measured. The triangle TOG can then be drawn to scale and the range from the guns to our own troops can be measured from the drawing (*see* Sec. 64, 2).

The clearance can now be worked out as shown in Sec. 77.

3. If our own troops are to advance, calculations must be made in a manner similar to the above to decide the point at which it will no longer be safe to fire at the objective. When this point is reached, fire must be directed on to ground in rear of the objective by increasing the elevation on the guns to such an extent as will give sufficient clearance to render our own troops safe when they reach the objective.

79. Organization and control of indirect fire.

1. Frequently in position warfare, and on occasions in war of movement, it will be necessary to undertake operations of a set piece nature. In such circumstances, indirect fire by machine guns must be so organized and controlled as to admit of a high degree of flexibility, in order that new targets presenting themselves may be engaged with rapidity and accuracy.

This necessitates simplicity of :—

Organization : Laying : Fire control : Drill.

2. *Organization.*—(a) Guns will be organized into groups. A group normally consists of from 16 to 32 guns; more than this number of guns tends to render the group unwieldy.

A group may, therefore, consist of from 2 to 4 platoons. It is commanded by an officer who is designated group commander.

A group may be divided into two or more sub-groups each of which may consist of one or more platoons.

Circumstances may sometimes render it necessary to treat a section as a sub-group.

Each gun is commanded by a N.C.O. or senior private, who is not the firer of the gun, and is known as the gun commander.

(b) The *Group Commander* issues orders dealing with the tasks allotted to each of his platoons. These orders are contained on the Group Organization Chart. (A.F. W. 3766.)

(c) The *Troop or Platoon Commander* works out the actual data to enable his guns to engage the allotted targets. These data are contained on the Troop, Platoon or Section Chart. (A.F. W. 3767.)

He also issues definite instructions to each gun commander on the Gun Chart (A.F. W. 3768), which is extracted from the Troop, Platoon or Section Chart.

He is responsible for the control and supervision of the fire of his troop or platoon and for estimating the amount of ammunition and supplies required.

In order to facilitate control, he should prepare a Fighting Map on the Fighting Map Tracing (A.F. W. 3769).

(d) The *Gun Commander* will control the fire of his gun in accordance with the instructions on the gun chart; or as ordered by the platoon commander.

He is responsible that the correct direction and elevation are placed and maintained on his gun.

NOTE.—Specimens of the above Army Forms are given in Appendices VII, VIII, IX and X.

3. *Laying.*—The preparation of a troop or platoon for indirect firing should be carried out in a systematic manner on the following lines—

(a) The gun detachments will assemble under cover with the necessary equipment. Having received their orders, they will move off and mount guns on the positions which have been previously indicated by the troop or platoon commander. The intervals between guns vary according to local conditions, concealment, &c., and are normally about 10 to 15 yards.

(b) The guns are next laid on their parallel zero lines, and zero posts put in.

(c) If an angle of switch is necessary to engage the desired target the order "All guns—degrees right (or left)" will be given by the troop or platoon commander, who obtains the required angle of switch from the Chart or Fighting Map. Target posts will then be put in.

(d) Distribution, if necessary, will then be ordered; gun commanders will adjust the bar foresight to the required amount, and firers will re-lay on the aiming mark.

NOTE.—Gun Charts should be used whenever possible, in which case (c) and (d) will be combined into one operation (angle of deviation from zero line).

(e) Elevation is then ordered; this may either be issued verbally by the troop or platoon commander or taken from the gun chart by the gun commander, who is responsible for setting the clinometer and seeing that the correct elevation is placed and maintained on the gun. After the gun has been laid for elevation, sights will be aligned on the aiming mark.

(f) The order will then be given to "Load."

(g) The amount of traverse will be ordered.

(h) The rate of fire will then be ordered, followed by the signal "Fire."

4. *Fire control.*—The fire of the troop or platoon will normally be controlled by its commander in direct communication with all his guns. He will act under the instructions of his group commander, who will establish communication with him.

Observation of fire must always be sought either from the vicinity of the guns or by a forward observing officer in communication with the troop or platoon commander by telephone or visual signals.

Careful estimate must be made of the ammunition supply, and strict fire control by gun commanders is necessary to prevent undue expenditure of ammunition.

5. *Target frontage per gun.*—When the fire of a troop or platoon is distributed over a linear target the frontage allotted to any gun should not exceed 50 yards. This applies to frontal, enfilade and oblique fire.

6. *Type of fire.*—A troop or platoon may be called upon to perform the following tasks—

(a) To engage a definite linear or area target with the object of keeping down the enemy's fire, harassing his communications and movements, or securing fire effect upon an observed target.

(b) To sweep ground in front of our advancing troops, in which case the range increases (generally by lifts of not less than 200 yards) according to the rate of advance of the troops, and must at all times be sufficient to ensure the necessary clearance over them at all points of their advance.

These tasks can be carried out by frontal, oblique or flanking fire. The last two admit of the closest support being given to advancing troops, but involve advanced positions for the guns and increased length of communications. Frontal fire is generally employed, but safety considerations usually require that the beaten zones shall fall 300 to 400 yards in front of the furthest positions of our own troops.

CHAPTER XIII.

NIGHT FIRING. EQUIPMENT.

80. Night firing.

1. Two cases will usually occur—

- i. *Gun brought into position and laid by day.*—The simplest method of night firing is when the gun can be brought into position and laid on the target by day, the night firing lamp (Appendix XI) being put out at a suitable distance from the crosshead in line with the target. After dark the sights should be aligned on the lamp without altering the direction or elevation of the gun.

If the target is not visible, indirect means must be employed to lay the gun.

- ii. *Gun brought into position for the first time by night.*—In this case the problem is one of ordinary indirect fire, and two alternatives will arise—

- (a) If the gun position can be fixed by day, it should be marked by a small post. A second post must be put out in alignment with the target if visible, or by compass if invisible, 10 yards from the first post (which marks the position of the crosshead).

By night the tripod must be mounted accurately over the small post, and the night firing lamp placed in the same position as the second post. The gun can then be laid for direction. Elevation having been put on with the clinometer, the firer should raise his tangent sight slide until the sights are aligned on the lamp. He can thus maintain both direction and elevation.

- (b) If it is not possible to get by day to the position on which the gun is to be mounted at night, the following procedure should be adopted—

Obtain from the map the magnetic bearing of the target from the gun position, and the necessary angle of quadrant elevation.

On arrival at the gun position, direction should be put on by compass and elevation by means of the clinometer.

The night firing lamp should then be put out, and the firer should adjust his tangent sight slide until the sights are aligned on the lamp. Careful instruction must be given in the use of the night firing (luminous) sights (*see* Sec. 81).

2. The above methods can be adapted to the relief during darkness of a gun laid on a definite target by another gun to be laid on the same target.

In all cases it is advisable to employ a small amount of traversing and searching in order to make certain of including the target.

3. An electric torch is essential for reading graduations on the direction dial and tangent sight, and for setting and reading the clinometer.

Screens of wet canvas or sandbags, if stretched taut, have no effect on a cone which is fired through them, and effectively screen the flash. Care should be taken to screen the flash at the sides as well as the front. When firing at long ranges, screens can be so arranged as to defilade the flash.

4. When firing is carried out from positions some way behind our front lines, particularly when these are reached by overland routes, special precautions (such as posting sentries or wiring the danger area) must be taken to prevent endangering our own troops when passing near the gun position.

The safety of working parties and patrols in front of the forward positions must be ensured by liaison with infantry commanders.

81.—Equipment.

1. *Safety considerations.*—It is essential that the mounting is in a thoroughly serviceable condition, and that wear and looseness in the various bearings and joints are eliminated as far as possible.

Instructions for the care and overhaul of the Mark IV Tripod are given in "Notes on Care and Adjustment of the Mark IV Tripod," issued as an Addendum to the Handbook for the .303 inch Vickers Machine Gun.

The tripod must be erected on firm ground. If it is necessary to erect the tripod on soft ground, a T base (see Appendix XII) should be used.

2. In order to obtain the accuracy of direction required for indirect fire, it is necessary to be able to lay off to 10 minutes. This cannot be done by the direction dial at present in use and is carried out by means of—

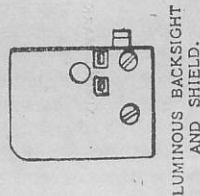
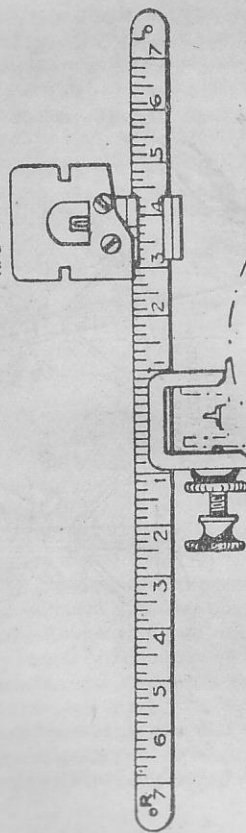
The bar foresight (Plate XIX). This is constructed so as to clamp on the wings of the foresight of the Vickers gun. The sliding foresight, sliding on the bar, can be clamped in any desired position. The bar is graduated in degrees, subdivided into 10-minute intervals. Any angle, up to 7 deg., can be "laid off" from the centre line of sight when the sliding foresight is set at zero. It should be noted that if deflection is required to the right of the centre line of sight, the sliding foresight must be moved to the left, and *vice versa*.

(To face page 232)

PLATE XIX.

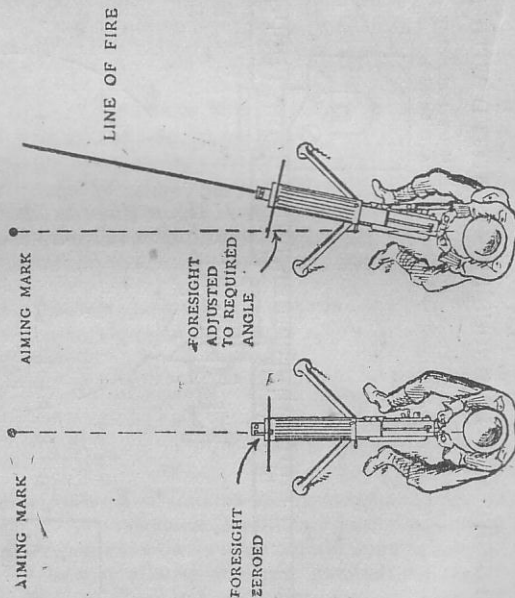
BAR FORESIGHT AND LUMINOUS SIGHTS FITTED WITH SHIELDS.

LUMINOUS FORESIGHT
AND SHIELD.



LUMINOUS BACKSIGHT
AND SHIELD.

PLATE XX.
USE OF BAR FORESIGHT.



For example, a gun is laid on its aiming post with the sliding foresight set at zero. Distribution of 1 deg. 20 min. (*e.g.*, to the right) is ordered; the gun commander sets the sliding foresight (*to the left in this case*) along the bar until the index reads 1 deg. 20 min.; the firer then re-lays the gun on the aiming post. (Plate XX).

In order to guide the firer in his traversing, and for firing in darkness, the standard luminous foresight can be clipped on to the sliding foresight. A shield is fitted to the luminous foresight with the object of facilitating aiming at night. The two notches cut in the vertical edges of this shield enable the firer to relay at the ends of his traverse; the distance between either notch and the foresight corresponds to 1 deg. traverse, giving a total of 2 deg.

To facilitate laying, a small shield with an aperture sight has also been fitted to the standard luminous backsight, which should be used in conjunction with the luminous foresight.

3. *Direction and elevation dials.*—The direction dial has a rotary disc carrying the scale, which can be set to read 0 deg. (*i.e.*, can be zeroised) in whatever direction the gun may be pointing. The gun may then be swung right or left until the desired angle is read directly from the scale.

It is graduated from 0 deg. to 180 deg. on each side.

The elevation dial is fitted to the elevation wheel, one complete turn of which elevates or depresses the gun 4 deg.

The dial is divided into four main divisions each of 1 deg.; each of these is subdivided in 5 min. intervals.

The dial is more often employed in searching fire than for putting elevation on the gun, which is usually put on by means of the clinometer.

In order to "zeroise" the dial without altering the elevation of the gun, the elevating wheel should be held from beneath to prevent it from turning; the clamping screws can then be loosened, the dial

rotated until the zero is under the pointer, and the screws clamped up again.

4. *Angle of sight instrument Mark II.*—This instrument consists of a brass box forming a prismatic telescope, the eyepiece of which is so arranged that besides the view and a horizontal and vertical line in the instrument, a spirit bubble can be seen. The bubble can be inclined to the line of sight, and the inclination read off the degree and minute scales.

The magnification of the telescope is about three diameters, and the weight of the instrument in case is about 1 lb. 8 oz.

The instrument is provided with two scales, one of which reads whole degrees, the other a micrometer scale which reads to minutes.

The degree scale is graduated in single degrees from 0 deg. to 15 deg. elevation and 10 deg. depression, the latter being filled in white on black.

The micrometer is graduated every 5 min., numbered every 10 min. in both directions, and coloured to agree with the degree scale.

A gunmetal slide is fitted to the base of the instrument which enables it to be mounted on the "Stand, telescope, Field Artillery," or Stands No. 4 Director, Mk. 1. It can then be used as a director for measuring angles in horizontal and vertical planes.

5. *Clinometer Vickers, .303 inch gun, Mk. I.*—This instrument consists of a manganese bronze casting called "the cradle." The upper surface is cut to form the arc of a circle in which the arc can slide, and to the lower surface is attached a cast steel base adapted to rest between the side plates of the gun when the rear cover is raised.

A scale of degrees from 0 deg. to 20 deg. elevation and 20 deg. depression is engraved on one face and is read by an arrow on the arc. The graduations for elevation and depression are filled in with black and are numbered every 5 deg. and followed by the letters "E" and "D" respectively.

A worm spindle is fitted in two bearings in the cradle, the rear end being on a pivot. This allows of the worm being put out of gear with the arc for quick setting, by pressing downwards on the front end of the worm spindle.

A spring is provided to keep the worm spindle and arc in gear.

Two micrometer collars are fixed to the worm spindle, the forward one for reading depression in minutes, the rear one for reading elevation in minutes.

The micrometer collars are divided every 5 min. and numbered every 10 min., and are coloured the same as the degree scale. The figures on the micrometer collars have the letters "E" and "D" engraved underneath to indicate elevation and depression respectively.

At the rear end of the worm spindle a milled head is firmly attached, and one turn of this milled head represents one degree.

The arc is shaped to slide in the cradle. On its under surface are cut teeth, into which the worm gears. Attached to it by two screws is an adjustable reader for the degree scale. On its upper surface is attached a spirit bubble, the underside of which is rendered luminous for night work by means of radium paint.

The approximate weight of the clinometer and case is 3 lb. 6 oz.

Engraved on the base is an arrow and the word "target." This is to indicate the correct direction in which to place the clinometer on the gun.

6. *Zero post.*—This is an iron stake 3 feet long and $\frac{3}{4}$ inch in thickness. The upper end is formed into a ring about 4 inch in diameter, the lower end being pointed to facilitate pressing into the ground.

The stake is painted uniformly drab and weighs approximately 4 lb.

7. *Target post.*—This consists of a single telescopic stand capable of being raised or lowered between the limits of about 18 inch and 4 feet from the ground.

The base of the stand is provided with a metal plate about $4\frac{1}{4}$ inch in diameter, and a spike 10 inch long.

The provision of the plate facilitates forcing the spike into the ground by means of the foot, and at the same time prevents the stand from sinking in too far in soft ground and helps to maintain it in an upright position.

The draw tubes are fitted with clamping screws which allow the stand to be fixed at the required extension.

The innermost draw tube is surmounted with a bracket and spring to which can be secured the night firing lamp (*see* Appendix XI) or day aiming mark.

The day aiming mark consists of a circular metal plate 4 inch in diameter. The front face is painted white with a black bullseye 2 inch in diameter; to the rear face is attached a socket which fits on to the bracket of the stand.

PART III.

WAR.

CHAPTER XIV.

CHARACTERISTICS OF THE MACHINE GUN.

82. *General characteristics.*

1. In the co-operation of the various arms on the battle-field, the machine gun must be regarded as a distinctive weapon with tactics of its own, which are neither those of the infantry nor of the artillery, but intermediate between the two.

Its value in attack is as great as in defence, and in every operation the offensive possibilities of the machine gun must be developed to the full.

2. The machine gun possesses the power of delivering a concentrated volume of fire which, owing to the ease of control, can be rapidly directed against any desired object, and facilitates surprise effect.

Being a mechanical weapon it is liable to accidental cessation of fire, but in skilled hands and by the provision of spare parts and the use of ammunition which is suitably packed, its automatic action is rendered highly reliable.

3. Its chief characteristics are :—

i. *A fixed tripod mounting and an all-round traverse*, which give the following results :—

(a) Accuracy of fire is increased by the reduction of the personal factor. Fire over the heads of our own troops may be carried out with safety. Effective fire is possible at long ranges. Direction and elevation can be put on and maintained both by day and night, and indirect fire can be employed. The gun can be turned quickly in any direction.

(b) The fire is closely grouped so that its cone forms a regular beaten zone which is very long in proportion to its width. At close and medium ranges the fire of the machine gun is most effective, therefore, when delivered in enfilade. When close grouping is not desired, fire can be distributed by traversing, but distribution must be limited to about 50 yards of front per gun, in order that fire may be effective.

ii. *Strong mechanism, belt feed, and water cooling system*, which render the machine gun capable of sustained fire. Provided that arrangements are made for the renewal of the barrel, the supply of oil and water and the maintenance of the supply of ammunition, the fire of the machine gun can, for all practical purposes, be maintained indefinitely.

iii. *Smallness of bulk*, which facilitates concealment. The machine gun and the two men required to work it, occupy small space and therefore can be easily hidden from view.

iv. *The location of the machine gun* may be detected by any of the following :—

(a) *Steam*.—After about 600 rounds of continuous fire, the water in the barrel casing boils. The condenser, therefore, must be fitted carefully and in time.

(b) *Flash*.—The flash of the machine gun is discernible at night, in very dull weather, and against a dark background. This can be overcome by special devices.

(c) *Muzzle blast*.—The discharge of the bullets and gases from the muzzle creates a blast which may raise considerable dust when the gun is fired from a low mounting. This can be prevented either by wetting the ground beneath the muzzle or by laying down wet sand-bags. The blast will also produce a fan-shaped mark, which is clearly visible from the air and requires concealment by artificial means.

(d) *Noise of firing*.—The sound of a machine gun in action is unmistakable, but as the explosion at the gun is largely offset by the crack of the bullets in the air, the position of the gun cannot readily be detected.

v. *Comparative mobility*.—The mobility of the machine gun depends on its method of transport :—

When carried in the limbered wagon, the mobility of the machine gun on roads, tracks, or open ground is greater than that of the infantry.

When carried on pack, its mobility depends on the animal and the method employed to lead the animal. When the pack animal is led by a man on foot, the mobility is rather less than that of infantry ; when the pack animal is led by a mounted man, the mobility is rather less than that of cavalry.

When carried by the detachment its mobility is considerably less than that of the infantry on account of the weight of the gun, ammunition and equipment.

4. The following are the chief points to be noted in comparing the above characteristics with those of the Lewis or Hotchkiss guns. These weapons are cooled by air and are liable to become overheated after about 500 rounds of continuous fire. They are therefore less capable of sustained fire than the machine gun, and are the weapons particularly suited to engaging targets for which short bursts of fire are suitable. Lewis and Hotchkiss guns cannot be used for indirect or for overhead fire.

The machine gun has a stronger mechanism and is less liable to stoppages than either the Lewis or the Hotchkiss gun. As it is fired from a fixed platform the machine gun is more accurate and can carry out indirect and overhead fire. The machine gun with its accessories is much heavier than either the Lewis or the Hotchkiss gun: the latter can, therefore, be brought into action with greater speed.

CHAPTER XV.

GENERAL CONSIDERATIONS GOVERNING THE EMPLOYMENT OF MACHINE GUNS.

83. *Introduction.*

1. A comprehensive and, when possible, pre-arranged plan for the action of machine guns is necessary in order to ensure co-ordination of effort both in attack and defence. Unity of control is essential if full use is to be made of available resources.

It is rarely possible to arrange that machine gun sections or platoons acting independently shall co-operate effectively with each other.

Within reasonable limits, therefore, the larger the number of machine guns which can be placed under one directing authority, the less will be the overlapping and consequent waste of fire power, and the easier will it be to replace casualties by reserve guns.

2. The machine gun platoon is an integral part of the battalion, but co-ordination of effort can be ensured by "brigading" machine gun platoons. This method does not imply the massing of machine guns or that all the machine guns within the brigade will necessarily operate under the immediate control of the brigade commander. "Brigading" enables the brigade commander to allot machine guns on a tactical basis, *i.e.*, according to the nature of the operation in hand and of the ground over which it is to take place. After the brigade commander has decided on the allotment of machine guns to suit his plan of action, some machine gun platoons or

sections may remain under the orders of their battalion commander whilst the remainder operate under brigade control. By this means the available machine gun resources are disposed to the best advantage of the formation as a whole.

3. If, on the other hand, machine gun platoons are rigidly retained with their own battalions, irrespective of the tactical situation and of considerations of ground, waste or loss of machine gun fire may result. Situations will frequently arise necessitating the application or increase of machine gun fire on any part of the brigade front. In such cases the means of obtaining such fire from machine guns are simplified if the brigade commander has some machine guns under his immediate control.

4. In deciding as to whether machine gun platoons should be "brigaded" or should operate with the battalions to which they belong, a brigade commander must weigh the above considerations in relation to the operation in hand.

Generally speaking, if a brigade is operating on a limited or normal frontage, facilities for control and co-ordination will be good, and the best results will be obtained by "brigading" the machine guns. On the other hand, if a brigade is operating on an abnormally wide frontage, control and co-ordination of machine gun action by the brigade commander may not be feasible and it may then be expedient to leave machine gun platoons with their battalions.

5. When machine gun platoons are brigaded an officer must be appointed to command them. To facilitate reference this officer is hereafter designated brigade machine gun commander. His duties may be summarized as follows:—

- (a) To prepare, for the approval of the brigade commander, the plan of operations for the machine gun platoons of the brigade, both in offence and defence, and to co-ordinate these plans with those of the brigades on other flank.

- (b) To direct the tactical action of the machine gun platoons under his command, in accordance with the orders he has received. During the battle, by means of personal reconnaissance, he must keep himself fully informed of the situation and of the nature of the ground.
- (c) To arrange reliefs of machine gun units, and the maintenance of their personnel and material in the fighting line.
- (d) To be responsible for keeping infantry battalions informed as to the dispositions of the machine guns covering their respective sectors, and to ensure that close and constant liaison is maintained.
- (e) To supervise the siting and construction of machine gun emplacements in the brigade area.

In order that the brigade commander's plan of machine gun action may be adhered to, battalion commanders must not alter the disposition or tasks of machine guns unless a new and unforeseen tactical situation has arisen which is not covered by the original rôles allotted to the machine guns in the brigade plan. Should such a new and unforeseen situation arise, however, it is the duty of battalion commanders to issue fresh orders to the machine gun commander, at the same time informing superior authority of the action taken.

6. The considerations given in the remainder of this chapter are based on the characteristics outlined in Chapter XIV, and are applicable irrespective of whether machine gun platoons are operating with the battalions to which they belong or are "brigaded."

84. *Surprise.*

The material and moral results obtained by machine gun fire opened unexpectedly on suitable targets can hardly be over-estimated, and every opportunity for securing surprise effect must be sought.

85. *Enfilade fire.*

1. At close and medium ranges, enfilade fire gives the best results with the minimum expenditure of ammunition. Normally, frontal fire at these ranges should not be used unless an exceptional target presents itself.

2. The use of enfilade and oblique fire facilitates concealment, if machine gun positions can be selected which are defiladed from the front.

86. *Cover and concealment.*

1. Sustained fire and surprise effect are both dependent upon the skilful use of ground and cover while the machine gun is being brought up to its position, and when it is in action. The provision of suitable equipment enables machine guns to deliver effective fire from positions in which they are completely concealed from observation by the enemy from the ground. Such concealment may confer immunity from hostile fire.

Air reconnaissance reduces to some extent the possibilities of complete concealment, but by careful siting and the use of camouflage machine guns will escape observation from the air.

2. Groups of horses and wagons in the open are easily seen from the air, and even when the machine guns are not visible may be an indication of their presence. Every step must therefore be taken to ensure concealment of led horses and limbered wagons.

3. Concealment, both as regards position and manœuvre, must be foregone if adequate reasons present themselves. To support infantry and to enable it to effect its purpose machine guns must be prepared to act with great boldness.

87. *Harassing fire.*

1. The objects of harassing fire are to lower the enemy's moral, impede his movement and dislocate his communications. Harassing fire will generally be carried out at night or in foggy or misty weather.

2. After a successful attack harassing fire may be employed with a view to preventing the enemy reforming on a new position.

3. During a period of stationary warfare, the execution of harassing fire must never be allowed to become a mechanical and perfunctory performance. It should be carried out in short bursts of varying duration at irregular intervals and whenever possible from improvised positions, so as to avoid disclosing the actual battle emplacements.

4. To obtain the best results machine gun harassing fire should be carried out in co-operation with the artillery and mortars, the general plan being based on information provided by the intelligence branch of the general staff.

88. *Anti-aircraft defence.*

1. By reason of its design, the machine gun is not suited for organized aerial defence work, for which the Lewis gun is to be preferred. This does not absolve machine gun units from providing their own local protection against low flying aircraft.

2. As a general principle, machine guns which are not engaging ground targets, nor likely to engage them at the moment, should immediately open fire at hostile aircraft, provided that they are within range.

No aeroplane flying at a height of over 3,000 feet should be fired at by machine guns, and at night only those aeroplanes should be engaged which have been proved beyond doubt, by the actual dropping of bombs, to be hostile.

A good look out must be maintained, as only fleeting opportunities for engaging aircraft will occur.

3. Unless situated in a very conspicuous earthwork or natural feature easily discernible from the air, the risk of machine guns being located by a low flying aeroplane is comparatively small.

The crack of the bullet is misleading, and attention is not directed by it to the gun position. In addition to material damage inflicted, the moral effect of the fire is very great, and observation by the occupant of the aeroplane is rendered more difficult and more likely to be superficial.

In cases where there is reason to suppose that the position of the machine gun or guns might be disclosed (*e.g.*, in open country), the machine gun officer on the spot must decide whether or not it is advisable to open fire.

89. Co-operation.

1. Co-operation is the foundation upon which successful machine gun tactics rest. To ensure it, the closest possible liaison must be maintained.

2. The intentions of a commander for any operation should be communicated to the machine gun officer in the form of general instructions. It is important that latitude should be allowed to the machine gun officer in deciding upon the dispositions and methods of fire by which the general instructions can best be carried out, as the application of machine gun fire differs in many important respects from that of rifles or automatic rifles. Similarly orders given by the machine gun officer to his subordinates should generally be given as tasks in order that initiative may not be fettered when dealing with local conditions and unforeseen developments.

3. The object of the employment of machine guns is to support by fire the action of other troops. This support can only be ensured if the machine gun officer possesses a knowledge of the tactics of other arms, and seeks mutual understanding by means of personal liaison on all occasions. Similarly, the best results can only be obtained if commanders possess a general knowledge of machine gun tactics and the scope of machine gun fire.

4. It is essential that there should be the closest co-operation between the machine guns and the infantry. All machine gun commanders must know the plan of action of the infantry which they are to support; similarly, infantry commanders must be fully aware of the rôle and dispositions of the machine gun units supporting them. During the battle it becomes more than ever important that infantry and machine gun commanders should keep one another informed as to the progress of the fight and the action which is being taken.

5. Whenever a machine gun commander is allotted a task necessitating co-operation with a certain force of infantry, whether he is placed under the orders of the commander of that force or not, it becomes his duty to open communication with its commander, reporting to him in person, if possible, in order to obtain full information as to the character of the operation in which he is to co-operate, as to the proposed method of its execution and the task allotted to the machine guns.

6. Co-operation between artillery, mortars and machine guns is necessary in order that the whole scheme of fire power, in either attack or defence, may be brought into play with the maximum of effect.

90. Tactical control.

1. Tactical units must be kept intact and the number of tactical units employed must be sufficient for the task in hand. The tactical unit of machine guns is the section of four guns.

2. The maximum fire effect is obtained by the employment of collective fire from a number of guns operating under one control. The use of individual machine guns, operating alone, results in loss of control, difficulty of supply and dissipation of fire power.

91. *Reconnaissance.*

1. The time available for reconnaissance will vary according to the nature of the operation in hand; thus, in an encounter battle, or in the case of machine guns supporting cavalry in mounted action, little if any time may be available for reconnaissance, since the situation may require instant action.

The guiding principle is that, whenever possible, personal reconnaissance should be carried out by commanders before troops are committed to an engagement. (See F.S.R., Vol. II, Sec. 73.)

2. The methods to be adopted by a machine gun commander when reconnoitring in touch with the enemy have been dealt with in Sec. 41.

In a deliberate attack a machine gun commander must make himself acquainted by a close study of maps and aeroplane photographs, and by personal reconnaissance, with the ground over which the attack is to take place. He must take into consideration:—

- i. Positions from which initial covering fire can best be delivered.
- ii. Suitable places for fire positions as the advance progresses.
- iii. The best routes of advance and any natural obstacles likely to be encountered, both as regards personnel and transport.
- iv. Tactical features or other landmarks which will act as guides during the advance.
- v. The character of the enemy's defences and obstacles which will be encountered by the infantry at the various stages of the attack, and the facilities for machine gun support.
- vi. Where the greatest difficulties are likely to be encountered by the infantry.

vii. Whether the flanks are liable to become dangerously exposed; and

viii. The assembly positions and covered approaches most likely to be used by the enemy for counter-attacks.

3. A proper distribution of guns and allotment of tasks can only be decided upon after weighing all the above considerations, and in this connection, it is well to note that the more it is possible to lighten the tasks of machine gun units at the outset of an attack the more vigorously will they be able to intervene in its later stages, when the artillery support may be thinner and the enemy's resistance possibly stiffening.

4. Before undertaking a reconnaissance to decide on machine gun positions in defence, a machine gun commander must be informed as to:—

- i. The tactical features within the outpost zone which it is considered essential to cover by means of machine gun fire.
- ii. The localities or areas in the outpost zone to be occupied by the infantry.
- iii. The dispositions of the infantry in the battle position.
- iv. Those features or areas which are tactically essential to the defence.
- v. The general plan of artillery defence.

Unless this information is forthcoming, it will be impossible to select machine gun positions in accordance with the general plan of defence for all arms.

92. *Tactical use of limbered wagons.*

1. The gun and ammunition limbered wagons are essentially a fighting portion of the machine gun section; the two vehicles of the section must be regarded as an integral part of the section, and must ordinarily be with it.

2. The fullest use must be made of all transport in an offensive operation. Resort must only be made to man-handling when all other means of transport have been found impossible.

In open warfare machine guns will often be required to act ahead of the main body of the infantry, in order to consolidate tactical points already gained by advanced troops. It will often be necessary for machine guns to move faster than the infantry—for instance, machine guns, marching near the head of the main guard of an advanced guard, may be required to push ahead and hold ground to cover deployment. Similarly, when infantry have gained an objective, machine guns are required to push on quickly to that objective. On such occasions where the ground is suitable and the tactical situation permits, limbered wagons should be used for the rapid conveyance of guns and men.

3. If a route can be reconnoitred, or selected after a careful study of maps and aeroplane photographs, and if sufficient latitude can be allowed as to the line of advance, wheeled transport is usually able to reach its destination.

If the ground is likely to prove difficult for limbered wagons it may be advisable to employ limbers either (a) with a full team, or (b) with the leaders carrying guns and tripods on pack saddles. Limbers can be taken over almost any ground which is passable for pack animals.

4. When crossing exposed ground, limbered wagons should gallop for the next cover, and the machine gun detachments should work their way to it independently.

When in action, the limbered wagon can be left under cover close to the gun position, while the animals are taken back to a safe distance. The wagon will then serve as the ammunition reserve, and, if a change of position is ordered, can be loaded ready to move off as soon as the animals are brought up.

5. In operations in close country the use of limbered wagons will be restricted to roads and tracks, whilst in position warfare there will be little opportunity for the use of limbered wagons owing to the numerous obstacles met with in highly organized defences.

In these circumstances, as well as in mountain warfare, resort must be made to pack transport and man-handling. The employment of pack animals throws a considerable strain on men and animals, both as regards casualties and fatigue. Pack animals are difficult to manage under fire and should not be used unless it is impossible for limbered wagons to reach their destination.

93. *Inter-communication and liaison.*

1. The highly-developed systems of telephonic communication which are possible in stationary warfare cannot be maintained in a war of movement. It will very rarely be possible to provide any communication by wire forward of infantry brigade headquarters. Machine gun commanders must, therefore, accustom themselves to rely entirely upon other methods of inter-communication, such as visual signalling, runners, mounted orderlies, &c.

The two latter should be used sparingly, and then only when all other means of inter-communication have failed.

2. The importance of close liaison between machine gun and cavalry or infantry commanders cannot be over-emphasized. This liaison will be largely facilitated if the headquarters of machine gun commanders are situated in the vicinity of those of the commanders whose units they are supporting. Section commanders, however, must be in a position from which they can control their guns, and liaison with the commanders concerned can only be achieved if the machine gun commander is kept regularly informed as to the tactical situation. When the tactical situation permits, the machine gun commander will report personally to the infantry battalion commander.

It is the essence of liaison that its maintenance is the duty of both parties concerned.

94. Ammunition supply.

1. The administrative services deliver ammunition at the "ammunition refilling points," which are situated usually within one day's march of the fighting troops.

As a general principle, the supply must proceed from rear to front, that is to say, the supply should be pushed forward according to the tactical situation without waiting for demands from the firing line.

2. The reserves of ammunition held by machine gun units are divided into two lines:—

- i. Divisional S.A.A. column reserve.
- ii. Regimental reserve, i.e., one ammunition limbered wagon to each machine gun platoon.

The amount of ammunition carried in each line is as follows:—

Table of ammunition. Machine Gun Platoon (Infantry).*

Where Carried.	A Gun.	A Section.	A Platoon.
Gun limbers	3,500	14,000	28,000
S.A.A. limbers... ..	2,250	9,000	18,000
Total with unit	5,750	23,000	46,000
Divisional S.A.A. column ...	2,000	8,000	16,000
Total... ..	7,750	31,000	62,000

* This table is based on the present system of packing S.A.A. With the introduction of factory filled stripless belts in special boxes, some modification may have to be made.

3. The divisional S.A.A. column will march in accordance with orders received from divisional headquarters and, when an action is imminent, will usually push forward sections to connect with, and be affiliated to, the infantry brigades of the division.

4. On approaching the battlefield, the commander of a section of the divisional S.A.A. column will ascertain the position of the troops which he has to supply and will detach one or more orderlies to remain, for purposes of inter-communication, at the headquarters of the infantry brigade to which the section is affiliated.

5. The method of supply of ammunition on the battlefield is as follows:—

- i. The limbered wagon carrying the regimental reserve of machine gun ammunition will be sent up to section headquarters, as may be necessary, to replenish ammunition expended from the gun limbers.

It will be the duty of the platoon commander to decide how ammunition can best be brought up to the actual gun position. If the machine guns are not under fire and there is no danger of disclosing their position the ammunition limbered wagons may be driven close up to the gun position, or at any rate up to the position of the gun limbers. On the other hand, it may be necessary to carry out the replenishment by hand from a point some distance in rear.

- ii. As soon as one of the reserve machine gun ammunition limbered wagons is empty it will be refilled from the section of the divisional S.A.A. column, to which a written request for the amount of ammunition required will be sent.

- iii. Men, vehicles and animals belonging to the divisional S.A.A. column will not be sent further to the front than the brigade reserve of ammunition except in case of emergency.

6. When machine guns are brigaded, it will be necessary to form a brigade reserve of machine gun ammunition by withdrawing the ammunition limbered wagon from each machine gun platoon. The four limbered ammunition wagons will normally be grouped together in a selected position, which will be notified to all concerned and will usually be near brigade headquarters, where facilities for inter-communication are available. The method of supply of ammunition will be on the lines indicated in para. 5 above.

7. Until factory filled (strippless) belts packed in special boxes become available, it will be necessary to establish belt filling centres at platoon headquarters. The principle is that as much belt filling as possible should be done in rear, with a view to minimising losses in personnel and reducing movement near the gun positions.

8. When a force is acting on the defensive, it is generally possible to provide ample ammunition for the guns. At least 8 belts should be allotted to guns in defensive positions for use in firing on their most important lines of fire. The extra amount necessary for guns detailed to carry out harassing fire can be dumped at the gun positions and will vary according to the rate of fire ordered and the length of time for which it is required to be maintained.

A forward brigade ammunition dump, from which carrying parties can draw supplies for the guns, should be provided as far forward as it is possible to take transport.

The arrangements for drawing ammunition to replenish this dump will be on the lines indicated in para. 5 above.

9. The following modifications to the normal methods of ammunition supply apply to position warfare.

Before the attack is launched, dumps of ammunition for the use of machine guns which are to be employed in the initial covering fire should be formed at the actual gun positions.

In this connection, it must be borne in mind that barrage fire expends large quantities of ammunition.

A certain amount of ammunition should be carried forward by the machine gun detachments. The amount thus carried must depend upon the distance which is to be travelled, the condition of the ground, and the physical capacity of the men.

The danger of exhausting the detachments unduly must always be borne in mind.

Special carrying parties may be employed to carry forward additional supplies of ammunition.

This is laborious and expensive in men, and should not be resorted to more than is absolutely necessary. It must be remembered that when such carrying parties have to be employed, they will usually be drawn from the infantry.

The amount a man is given to carry should not, as a rule, be more than two filled belt boxes. The use, however, of tump lines or Yukon packs is of value in order to lessen physical fatigue, and thus to increase the distance over which the carrying parties can travel. It is not advisable to increase the load by means of these carrying devices, as the distance which can be travelled forms the primary consideration.

The supply of ammunition by limbered wagons or pack transport is the normal method, and must be employed whenever possible.

Arrangements may be made for ammunition to be carried forward in tanks, when these are available.

In an emergency, ammunition can be dropped from aeroplanes by means of parachutes. This must, however, be regarded as an abnormal method of supply.

CHAPTER XVI.

PROTECTION.

95. *Machine guns with outpost troops.*

1. The rôle of machine guns employed with outpost troops is the production of fire when the outposts are required to resist a hostile attack.

For this purpose, machine guns should be disposed so as to assist in the defence of the outpost line of resistance.

The outpost commander may decide to retain a proportion of the available machine guns as a reserve of fire power.

2. Normally, machine guns should not be disposed in front of the outpost line of resistance, but should be sited in positions from which effective fire can be brought to bear on to the main avenues of approach to the above line, the guns being disposed in sections or sub-sections according to the nature of the ground and of the task allotted. As it will be impossible to cover with machine gun fire all the possible avenues of approach to the outpost line of resistance, the outpost commander, or the commander of a sector of the outposts, must inform the machine gun officer as to the areas or localities in front of the line of resistance on which it is desired that the bulk of the machine gun fire shall fall in the event of a hostile attack. If the outpost line of resistance does not coincide with the piquet line, it will be of advantage if machine guns sited for the defence of the outpost line of resistance can bring fire to bear on to portions of the ground in front of the piquet line, either to assist the piquets in the defence of their posts or to cover their retirement on to the outpost line of resistance.

3. The general principles regarding the siting of machine guns in defence (*see* Sec. 115) and the selection of positions on the ground (*see* Sec. 117) apply generally in the case of machine guns employed in the outpost zone.

4. By day, unless the enemy is close at hand and battle imminent, it will not be necessary for machine gun detachments to occupy their battle positions, but they should be retained under cover ready to move into position when required. By night, however, machine guns should occupy their battle positions and the guns should be laid on fixed lines of fire which should be made known to piquet commanders.

5. Machine gun detachments will not be required to take part in the general observation and reconnoitring duties of outpost troops, but will be required to find their own sentries over machine gun positions.

96. *Machine guns with an advanced guard.*

1. The duties of an advanced guard render it necessary that great fire power should be available in the shortest possible time. An ample proportion of machine guns will, in consequence, usually be allotted to advanced guards, and complete tactical units should invariably be employed for this purpose.

2. The main duties of machine guns in an advanced guard will normally be:—

- (a) To assist in driving in the enemy's advanced troops by rapid development of fire at the required points.
- (b) To assist in holding any position gained and in covering the deployment of the main body.
- (c) To protect an exposed flank or flanks.

3. Machine guns should be placed well forward in the order of march in order to enable them to come quickly into action.

There will generally be opportunities for oblique or enfilade fire, of which full advantage should be taken.

Failing the engagement of targets by direct observation, the cross-fire from two or more sections of machine guns disposed so as to sweep suspected areas will often prove of value.

4. Opportunities for direct fire should be sought, and this type of fire should be employed as much as possible. This does not mean that indirect fire should never be employed, but in the mobile fighting of an advanced guard indirect fire methods will usually only be advisable when the officer controlling the fire is in a position to watch the movements of the infantry, to control his machine guns by word of mouth or by direct visual signalling, and to observe their fire.

5. If an attack on any particular locality becomes necessary, the employment of frontal fire by machine guns, covering an enveloping movement by the infantry, will usually prove most efficacious.

The bold and skilful handling of the machine gun limbered wagons will assume especial importance in the deployment and in the subsequent advance of the machine guns, as the advanced guard presses forward.

Mounted officers and orderlies and scouts on bicycles or on foot will be found invaluable for reconnaissance and inter-communication.

97. *Machine guns with a rear guard.*

1. As a rear guard will usually be required to hold positions with the minimum number of men, an ample proportion of machine guns should be allotted to it.

Experience has shown that well-placed and skilfully handled machine guns can, with the support of a small number of infantry, check for long periods the advance of comparatively large numbers of troops.

2. The principles upon which all rear-guard action should be based are laid down in F.S.R. Vol. II, Chapter VIII.

In the application of these principles, the following points in connection with the employment of machine guns should be noted:—

- (a) Direct fire should be used. Fire should be opened at long ranges on suitable targets, but with due regard to the supply of ammunition. Positions should be selected to give a wide and comprehensive field of fire.
- (b) Machine guns should be disposed mainly on the flanks.
- (c) Machine guns should be handled in sections as far as possible.
- (d) Defence in depth must be maintained by the retirement of alternate sub-sections or sections.
- (e) Machine guns should be sited with due regard to the prospects of ultimate withdrawal.
- (f) Full use should be made of limbered wagons and pack animals for withdrawal, as well as for forming ammunition dumps in suitable places near positions on which the machine guns will fall back.
- (g) Surprise effect must be sought, but the necessary concealment must not interfere with the mobility which is necessary to ensure that successive withdrawals occupy the minimum amount of time.

3. While the withdrawal of machine guns should not take place until the latest possible moment consistent with the tactical situation, the necessary arrangements should be foreseen and prepared.

These arrangements will involve:—

- (a) The previous selection of positions in rear. If these positions can be sited so as to cover the flanks of the more forward machine guns, additional power will be given to the defence.
- (b) The reconnaissance of covered lines of withdrawal.
- (c) The close proximity and full use of limbered wagons and pack transport.

4. While, as a general principle, a portion of the machine guns should be left in rear to cover the withdrawal of the bulk of the infantry, it is essential that parties of mobile troops should remain to cover the withdrawal of the machine guns. As soon as the bulk of the infantry has withdrawn and re-organized on its new position, a proportion of the machine guns which have covered the withdrawal should be released to take up fresh dispositions in depth.

98. *Local protection of machine guns.*

1. On the march, or in battle, machine guns will normally be protected by the disposition of other troops.

If, however, machine guns are detailed to carry out a march by themselves, or are placed in an exposed position in hostile territory, it may be necessary to detail an escort to accompany them, since machine guns have only limited means of protecting themselves. If this has not been done it is the duty of the machine gun commander to apply to the nearest commander of infantry or mounted troops for a suitable escort. The senior officer present, whether machine gun commander or escort commander, will issue the necessary instructions to the escort, but the commander of the latter must in either case have a free hand in carrying them out.

2. "Every commander is therefore at all times responsible for the protection of his command from surprise" (F.S.R., Vol. II, Sec. 79). Nothing can absolve the machine gun commander from taking steps to ensure his own protection, for which he must not rely entirely on the protection afforded by the dispositions of other troops. When moving from one part of the battlefield to another, scouts must be sent out well to the front and flanks. When in action, machine guns should be able to protect their own front provided there is no dead ground within close rifle range. Any such dead ground or concealed approaches must be kept under continuous observation or frequently patrolled.

CHAPTER XVII.

MACHINE GUNS IN THE ATTACK.

99. *Duties in the attack.*

1. The rôle of machine guns in the attack is the energetic and determined support of the infantry by fire.
2. This rôle involves the following duties :—
 - (a) The immediate support of the leading infantry.
 - (b) The protection of the flanks of the infantry against counter-attacks.
 - (c) Holding tactical localities upon which the infantry can rally if driven back.

100. *Dispositions in the attack.*

1. In drawing up a plan of machine gun action in the attack, due consideration must be given to the necessity for retaining a proportion of the available machine guns as a reserve of fire power, which will be available for offensive or defensive action as the situation may demand.

2. The nature of the duties enumerated in Sec. 99, necessitates the dispositions of machine guns *in depth*. "In order to provide a defence in depth against hostile counter-attacks, the leading machine guns should follow the attacking infantry at such a distance as will allow the machine guns to form centres of resistance on which the infantry can rally in case the leading troops are driven back by the enemy. As a general rule, therefore, no machine guns should be with the leading companies." (F.S.R., Vol. II, Sec. 121. 3.)

3. The machine guns detailed to carry out the duties given in Sec. 99 will normally be divided into:—

- i. Forward guns; whose rôle is to work forward in immediate support of the leading infantry.
- ii. Supporting guns; which will be disposed so as to: (a) consolidate tactical localities as they are won (thus freeing infantry for the further advance); (b) cover the flanks; (c) increase the volume of covering fire where necessary.

4. In order that *continuous* support may be afforded to the attacking infantry it will frequently be necessary for supporting machine guns to advance through and beyond the forward machine guns, the latter taking up (temporarily) the rôle of supporting guns. Normally, therefore, both the forward and the supporting machine guns must operate under the orders of one machine gun commander.

This system of "leap-frogging" will be particularly necessary in operations in which the advance may be continuous and may cover considerable distance, *e.g.*, where the enemy has been driven back but is still offering resistance.

On the other hand, in operations in which the attacking force has a limited objective, it will often be advisable for the same machine guns to act as forward guns throughout the operations in hand up to the consolidation of the objective.

5. No hard and fast rule can be laid down to determine the proportion of machine guns to be held in reserve, or the actual division into "forward" and "supporting" guns in an attack. The following must be considered when making initial distributions:—

- i. Nature of the operation and rôle of the attacking force.
- ii. Information as to hostile dispositions and strength.
- iii. Nature of the country.
- iv. Amount of artillery available to support the attack.

As a general rule the proportion of forward guns should be kept to the lowest possible minimum. The more machine guns detailed for this rôle the less will be the depth of the machine gun dispositions. The general distribution at every stage of the attack must be such that:—

- (a) Sufficient machine guns are held in reserve with which to obtain superiority of fire in the event of any serious resistance being encountered.
- (b) Rapid intervention to a flank may be possible.
- (c) Adequate distribution in depth may be maintained as a defence against possible counter-attack.

6. In an encounter attack in close country, owing to the difficulty of accurately locating the position of our own troops, overhead fire will be subject to greater limitations than in more open country. In this case the proportion of forward machine guns using direct fire in immediate support of the infantry should be increased.

These machine guns should take full advantage of the covered approaches available in close country to push well forward and endeavour to gain surprise effect.

When a deliberate attack in close country is carried out according to a definite time table and with large scale maps available, indirect overhead fire is feasible, and the necessity for increasing the proportion of forward machine guns will not arise.

7. It may be considered advisable to detail a proportion of the forward machine guns to consolidate the objective. Machine guns so detailed should not be expected to perform other tasks during their advance, as it is essential that they should arrive at their positions with an adequate supply of ammunition.

101. Action of forward machine guns.

1. When deployment for action has been ordered, the forward machine guns should move to positions of deployment which must be chosen with reference to:—

- i. The position of deployment of the infantry units which they are to support.
- ii. The proposed route of advance.

In a deliberate attack, and in position warfare, it will usually be necessary to take up these positions during the night before the attack. In this case previous reconnaissance of these positions is desirable, both by day and night, if time permits.

2. The forward machine guns will not necessarily advance from their position of deployment at the same time as the leading lines of infantry, neither must the former be tied to the infantry during the advance.

It must be remembered that the weight of the gun, tripod and ammunition loads prevent the machine gunner from keeping up with infantry in a rapid advance.

3. In order that they may be able to afford immediate support to the leading infantry, the forward machine guns must be prepared to deal rapidly with hostile opposition which interferes with the infantry advance or threatens its flanks, to cover gaps in the attack or to hold tactical localities on which the leading infantry can rally if driven back.

These duties call for aggressive action, and necessitate readiness to open fire at *short notice*. The line of advance of these machine guns should be the line which will take them with the least possible delay to the points from which they can most effectively engage the enemy. But mere gain of ground should not be attempted if it entails the sacrifice of a position already occupied which affords better facilities for carrying out the task in hand.

Machine guns are not suited to take part in the close struggle for progress.

Immediate support involves constant vigilance on the part of the machine gun commander, combined with readiness for immediate action by all ranks. Constant relief is therefore necessary to ensure tired infantry being covered by fresh machine gunners. Such reliefs will only be possible when there are sufficient machine guns in reserve.

4. Commanders of forward machine guns will:—

- i. Carry out personal reconnaissance well ahead of the unit.
- ii. As the advance progresses select fire positions which will:—
 - (a) Enable the greatest support to be given combined with the minimum number of bounds.
 - (b) Give command of ground from which hostile fire is likely to hold up the advance.
 - (c) Protect the flanks against counter attack during the advance.
- iii. Use direct fire whenever possible, as the time taken in applying fire must be as short as possible. Indirect fire, however, should be used when necessary, but in such cases only the most simple method should be employed, *i.e.*, T.O.G. (short base).
- iv. As far as possible maintain liaison with the commander of the infantry whose advance the machine guns are supporting. Keep him informed of the disposition of the machine guns and the situation in vicinity and report personally to him from time to time as the tactical situation permits. Liaison is often difficult, but occasionally useful information can be obtained from the headquarters of another unit.

- v. As unexpected situations arise, decide on the immediate course of action. If this action conflicts with the initial plan inform the infantry commander as regards the action taken.

102. *Action of supporting machine guns.*

1. The supporting machine guns may be employed to carry out the initial programme of covering fire in co-operation with the artillery, whilst the forward guns are in position of readiness to advance in immediate support of the leading infantry.

The subsequent advance, by bounds, of the supporting guns will be necessary for the purpose of increasing the volume of covering fire on those localities or frontages where, as the situation develops, the hostile resistance is found to be preponderant.

2. In selecting positions for the above purpose the subsidiary tasks of the supporting guns, viz., consolidating successive objectives as they are gained by the leading troops, covering gaps in the attack and affording protection to the flanks, must not be overlooked.

The rôle of the supporting guns necessitates active forward reconnaissance by the machine gun commanders in charge of these guns.

3. In a deliberate attack upon a well-organized position the machine guns employed to carry out the initial programme of covering fire should, as far as possible, be sited in inconspicuous positions in the areas of lesser shelling and in places which are usually unoccupied by troops.

When time permits, emplacements should be dug beforehand, and stocked with water and S.A.A., and, if required, a belt filling shelter should be erected in the vicinity

Machine guns detailed for employment in the initial programme of covering fire may have to occupy their allotted positions one or more days before the attack. In such cases, every precaution for concealment must be taken.

Work should be done at night and concealed by camouflage by day.

4. In a deliberate attack when the depth of the advance is limited, the positions for the supporting guns should, if possible, be chosen with a view to the avoidance of a move during the operation.

Where, owing to the depth of the attack, it is necessary for machine guns employed on the initial programme of covering fire to carry out a move in the performance of their task, this move should invariably be regulated by a time table and the approximate location of new positions must be fixed beforehand by means of a careful study of the ground.

Positions where it is probable that the enemy will put down an artillery barrage must be avoided. Camouflage material should be taken forward to assist in the concealment of the new positions.

103. *General rules governing the advance of machine guns.*

1. When advancing, all machine guns, whatever their immediate rôles may be, should move forward by bounds from one position to another along pre-arranged routes. These positions should be reconnoitred by platoon or section commanders during the advance.

2. During the advance concealment must be sought, not only from direct ground observation, but also from the air, and conspicuous points liable to shelling by the enemy's artillery should be avoided.

3. During the initial stages of a deliberate attack, the forward movement of machine guns can generally be fixed according to a time table, but, as the advance progresses, it will be necessary to give subordinate commanders a freer hand.

4. Every use must be made of limbered wagons (or failing them pack transport) to get the machine guns forward quickly and to prevent the premature exhaustion of detachments.

5. *Fire and movement.*—Although the principle that movement should be covered by fire, does not apply so much to the movement of machine guns as to the action of infantry in the fire fight, nevertheless, the principle must be thoroughly understood and often applied by machine gun officers. Methods must, of course, be adapted to the tactical situation at the moment, and to the task in hand, but, in many situations, where it becomes necessary for a machine gun platoon to move from one position to another, one section should move, covered by the fire (if necessary) of the other section. The latter should only leave the original position when the section which moved first is in the new position. The same method also applies to the sub-sections of a section, and should generally be adopted by machine guns which have been detailed for the protection of a flank, in addition, perhaps, to other duties.

104. *Mutual support and exercise of initiative.*

1. The principle of mutual support must always be borne in mind. Thus machine guns, which have been detailed for the immediate support of a particular unit, must always be prepared to cover the advance of a neighbouring unit, if the opportunity should arise.

2. Where the character of the country over which the attack is to be made particularly lends itself to mutual support, definite arrangements can be made in advance, but such support will be found

more often to depend upon the exercise of initiative by the machine gun commander on the spot.

105. *Fire tactics.*

1. The fire of machine guns may be either direct or indirect. Primarily the machine gun is a weapon for direct fire, but indirect fire may be usefully employed to search localities on which direct fire cannot be brought to bear, and to harass the enemy's back areas and communications. Indirect fire also permits of distribution in depth without undue sacrifice of fire power. When a target cannot be engaged by direct fire, the machine gun officer must immediately endeavour to engage it by indirect methods.

2. Direct fire over the sights at the target is the most effective form of machine gun fire. But although frequent opportunities will be forthcoming for employing, with effect, the direct fire of machine guns in open fighting, both in attack and defence, the opportunities for using this form of fire to support infantry in the attack of highly organized defences are less numerous. Full advantage must, therefore, be taken of the offensive power available in the indirect fire of machine guns to support the infantry in an attack of this nature, for which purpose barrage fire may often be employed.

3. Barrage fire by machine guns is the fire of a large number of guns acting under a centralized control, directed on to definite lines in which the frontage engaged by a gun seldom exceeds 50 yards. "The object of barrage fire is to prevent the enemy from manning his defences in time to arrest the advance of the assaulting infantry." (F.S.R., Vol. II, Sec. 118, 9.)

4. Barrage fire is carried out by :—

- i. Artillery.
- ii. Machine guns.
- iii. Mortars.

In any operation the best results can only be obtained by conceiving the barrage scheme as a whole and allotting to the different arms tasks which their characteristics render them most fitted to carry out. In this connection the limitations of machine gun range, and the necessities as regards clearances over the heads of our own troops, must be borne in mind when deciding which part of the ground to be barraged is most suitable for the application of machine gun fire.

5. There are two types of barrage fire :—

i. *Creeping barrage*.—In which the barrage moves over an area of ground, in which case the machine gun barrage would be synchronised with the artillery time table, thus searching the ground over which attacking troops are advancing, or denying the use of certain areas to the enemy, &c. A creeping (machine gun) barrage goes forward, usually 200 yards at each lift. It is frequently put down 300 to 400 yards (according to safety considerations) beyond the 18-pounder barrage.

ii. *Standing barrage*.—Put down on a definite line and remaining there as long as required; used for the protection of troops consolidating, or meeting a hostile attack, &c. It is also used during an advance, in which case it remains on its line as long as safety and other considerations permit, and may then lift on to a second line further in advance.

6. When bombardment precedes an operation in position warfare, those machine guns which have been allotted for barrage fire usually carry out "harassing fire," which is regarded as an integral part of the preliminary bombardment.

The object of this fire is to :—

- i. Lower efficiency of hostile working parties.
- ii. Increase difficulty of transport of munitions and supplies.
- iii. Cause deterioration of the enemy's *moral*.

This object can be attained by engaging the following targets :—

- (a) Targets previously engaged by the artillery—more especially wire-entanglements and defences that have been damaged.
- (b) Communication trenches which can be taken in enfilade.
- (c) Routes, tracks taken by ration parties and reliefs, dumps, tramways, the areas between communication trenches, &c.
- (d) Any field battery positions which may be within range of machine gun fire.

By close co-operation between machine guns and other arms it is possible to drive the traffic from overland routes into the communication trenches, thereby causing :—

- (e) Congestion and delay.
- (f) Casualties from the artillery searching the communication trenches with their enfilade guns.

During the period more closely approaching the day of attack when the hostile defences have been damaged and the *moral* of the garrison has been shaken, the plan of concentrating the fire of machine guns on to carefully chosen centres of activity, and opening rapid fire for a short period is effective. This type of fire is known as "Area shooting." This treatment should be applied to different points at irregular intervals.

7. The objects of barrage fire on the day of attack may be summarized as follows :—

- (a) To place a protective barrage at every stage of the advance.
- (b) To prevent supplies of food and ammunition being brought up.
- (c) To prevent reinforcement of the garrison, or its retirement, if attempted.
- (d) To prevent the enemy manning his parapets and installing his machine guns.

- (e) To interfere with the active use, by the enemy, of machine guns in his defended area.
- (f) To destroy *moral*.
- (g) At all times to save the infantry from casualties by keeping down the fire of the hostile infantry, machine guns, &c.

As a result of this the infantry are assisted in :—

- i. Advancing and seizing their objectives.
- ii. Consolidating ground won.

8. In order that machine guns may carry out the rôle allotted to them in the general barrage scheme, the machine gun barrage must fulfil the following conditions :—

- i. It must be applicable equally to the deliberate attack where there is time for preparation, and to the later stages of large operations which involve the forward movement of units to new positions from which to create another barrage.
- ii. It must also apply to conditions of mobile warfare, becoming relatively more important as the troops get out of range of the bulk of their own artillery.
- iii. It must be flexible, *i.e.*, it must be possible to create a zone of intense machine gun fire on any area within range with accuracy and rapidity.

9. Details regarding the organization of machine gun barrage fire are given in Appendix XIV.

106. *Machine guns in the attack on a wood or village.*

- 1. The attack on a large wood, which cannot be enveloped or passed by, will consist of one or more of the following three phases, each of which will as a rule be entirely different in character, *viz.* :—
 - i. The fight for the edge of the wood.
 - ii. The struggle in the interior.
 - iii. The debouching from the wood on the enemy's side.

2. The attack on the edge of a wood differs in no way from the attack on any other position, and no special comment on the handling of machine guns is necessary, except to point out that machine guns should not be pushed into the wood until it is clear that the infantry have made good some extent of ground beyond the near edge.

3. As soon as the infantry have secured a definite lodgment in a considerable portion of the interior, some of the forward machine guns should be pushed up in close support. In addition to assisting the advance of the infantry by means of direct fire, these machine guns will be of value in securing the flanks and in assisting to beat off counter attacks. Care must be taken not to allot tasks to these machine guns which would be better performed by Lewis guns.

4. As soon as the wood has been cleared of the enemy and the far edge gained, opportunities should be sought for pushing forward machine guns on the flanks of the wood to positions whence they can support the further advance of the infantry.

If this is not feasible, owing to the wood being of very large dimensions, it will be necessary to increase the proportion of forward machine guns to assist the infantry in debouching from the wood by means of direct covering fire.

5. In the case of small woods, forming part of a hostile defensive position, the attacker will probably endeavour to outflank and envelop rather than attack them frontally. In this case machine guns will be most usefully employed in covering the enveloping movements of the infantry by fire directed against the front and flanks of the locality which is being surrounded. For this purpose a large proportion of the available machine guns will be employed with advantage for long range covering and searching fire.

6. As the enveloping movements of the infantry progress, machine guns should be moved to suitable positions on the flanks of the locality, from which enfilade and oblique fire can be brought against

the flanks and rear of the hostile defences. Opportunities for doing so may frequently be offered to forward machine guns detailed to support the troops attacking to the right and left of the wood, from whose progress the enveloping of the wood may result. Long range fire from machine guns can also be used to cover the exits from the wood, thus preventing the arrival of hostile reinforcements and barring lines of retreat to the defenders.

7. The above principles apply equally to the handling of machine guns in the attack on a village.

107. Consolidation.

1. The forward machine guns can assist consolidation by covering the reorganization of the infantry and assisting in repelling immediate counter-attacks.

2. Where the attack is limited in depth, the arrangements for consolidation should be thought out beforehand in detail; the precision, however, with which instructions on this subject can be issued before the attack must in each case depend on the nature and scope of the operation as a whole.

Arrangements must also be made to utilize the long range fire of supporting machine guns to assist in consolidation by covering definite frontages or areas in front or on the flanks of the leading infantry.

By this means greater volume and organized depth will be obtained to deal with deliberate counter-attacks.

3. The following points are of general application :—

- (a) A pause in the advance may occur either in accordance with the general plan of attack, or owing to the strength of the enemy's resistance, the exhaustion of the attacking infantry, nightfall, or any other cause. When such a pause is anticipated, machine gun commanders should

at once reconnoitre the ground with a view to moving their guns, if necessary, into positions more suitable for defence in depth than those which they have occupied during the attack.

- (b) If the attack is likely to come to a standstill at dusk, it is particularly important that final positions should be selected and occupied, and range cards prepared, before the light fails.
- (c) Whenever there is a pause in the battle, and especially at dusk and at dawn, hostile counter-attacks are liable to develop.

At this stage, the infantry may be in unfamiliar surroundings, often exhausted by hard fighting, and perhaps somewhat disorganized. Machine guns can do much to protect the position and to safeguard the flanks. This may necessitate the placing of machine guns as a temporary measure in isolated positions, in which case the guns should be accompanied by an infantry escort.

- (d) The advisability of detailing definite machine guns before the attack for the special purpose of consolidating some particular tactical feature depends upon :—

- i. The importance which is attached to the retention of the feature in question.

- ii. The likelihood of a counter-attack in strength.

Where no serious hostile reaction is expected, it is usually better to keep machine gun resources well in hand.

- (e) The state of readiness for repelling a counter-attack should be supplemented during the night by a vigorous programme of harassing fire, arranged in co-operation with the artillery, on roads and tracks, covered lines of approach, and possible places of assembly.

108. *Machine guns in support of cavalry.*

1. The principles given in the foregoing sections are applicable generally to the action of machine guns operating in support of cavalry engaged in dismounted action.

2. When supporting cavalry engaged in mounted action the opportunities offered to machine guns will be fleeting; quickness of decision and speed in coming into action are, therefore, of first importance. The machine guns must be handled rapidly and boldly, and every effort must be made to open effective fire before the shock takes place.

To ensure effective co-operation the machine gun commander should accompany the commander of the cavalry unit or formation until the moment when the machine guns are required to be brought into action, and the former must be kept fully informed regarding the situation and the intentions of the cavalry commander.

109. *The machine gun platoon operating with its battalion.*

1. Whilst the principles expressed in the foregoing sections are applicable generally to the handling of a machine gun platoon operating with its battalion, certain modifications must in this case be imposed in the application of the principles enunciated regarding dispositions in the attack.

2. The machine gun platoon consists of two sections; each section is a complete tactical unit in itself and is subdivided into two sub-sections.

The sub-section of machine guns, however, is not a tactical unit.

3. It follows that the division of a single machine gun platoon into three parts, viz. :—

- (a) Forward guns,
- (b) Supporting guns,
- (c) Reserve guns,

is not practicable without breaking up tactical units, which leads to absence of control and dissipation of fire power, and must be avoided. Sufficient depth in the machine gun dispositions in the attack will be obtained if the two sections of the machine gun platoon are utilised to perform two of the three rôles mentioned above.

4. In determining on the rôle of his machine gun platoon in the attack, the first consideration of a battalion commander must be whether he will retain the whole or a portion of the platoon in reserve during the initial stages of the attack. In making a decision on this matter, a battalion commander will be guided by the considerations given in Sec. 100, 5.

In an encounter attack it will usually be advisable to retain in reserve one or both sections of the platoon until the situation is sufficiently clear to indicate on what portion of the battalion front machine gun fire is most required.

In a deliberate attack it may be expedient to utilise the whole platoon to afford covering fire during the initial stages of the attack, subsequently pushing forward one section for the immediate support of the leading companies whilst the other section is held temporarily in reserve, or is sent forward to consolidate a tactical locality already gained.

5. Before an attack is launched, the battalion commander must inform the machine gun platoon commander on the following points :—

- (a) The objective or objectives to be gained.
- (b) The frontage allotted to the battalion.
- (c) Whether any special measures are to be taken by the machine guns as to the protection of one or both flanks.
- (d) The nature and the amount of artillery support available.
- (e) The tactical localities which it is essential should be made good during the advance.

(f) Any particular measure required to be taken by the machine guns to assist in consolidation of the final objective.

6. On receipt of the above information, the platoon commander will decide on his plan of action, for which purpose he must, if time permits, carry out personal reconnaissance (*see* Sec. 91) not only of the ground over which the battalion is to advance but also of the ground on both flanks of the frontage allotted to the battalion.

7. If the battalion commander has decided to retain one machine gun section in reserve, the platoon commander must issue instructions for the action of the remaining section, which should normally be detailed for the immediate support of the leading companies and will then perform the duties of forward guns as laid down in Sec. 101.

8. If the battalion commander places both sections at the disposal of the platoon commander, the latter must allot tasks to the two sections in such a manner as to ensure that the platoon is disposed *in depth* throughout the advance. For this purpose he may detail one section to act in the rôle of forward guns, for the immediate support of the leading companies, retaining the other section more directly under his control, to act in the rôle of supporting guns, *i.e.*, for the consolidation of tactical localities, the protection of a flank or the increase of covering fire on any part of the battalion front as required.

9. In the tactical handling of the two sections on the lines indicated above, in order that *continuous* support may be afforded to the leading companies, "leap-frogging" between the two sections will often be necessary. (*See* Sec. 100, 4.) It will be for the platoon commander to decide when the rearmost section should be sent forward to take up (temporarily) the rôle of forward guns, or when it should be brought into action to increase the volume of covering fire on any particular locality.

In order that he may control such moves and ensure that they are carried out at the right time, the platoon commander must be in a position to watch the advance of the infantry and be in close touch with the rearmost section of his platoon. The platoon commander should not, therefore, be tied to his battalion headquarters during the advance.

10. In order that the best possible support may be afforded to the infantry during the advance it is essential that the platoon commander should retain general control of his sections.

For this reason machine guns should not be allotted to companies. It will frequently be necessary for machine guns to come into action from positions on the flank of, *i.e.*, outside, the frontage allotted to the battalion.

The distance from the flank of the battalion at which the machine guns should operate will be limited by considerations of liaison and inter-communication.

11. The platoon commander is responsible for the supply of ammunition to his sections. He must therefore control the movements of the S.A.A. limbered wagon which forms part of his platoon.

110. Machine gun platoons brigaded.

1. In order that he may prepare a comprehensive plan for the action of the machine guns, the brigade machine gun commander must receive instructions on the following points:—

- (a) The proportion of the available machine guns which the brigade commander intends to retain in reserve.
- (b) The objective or objectives to be gained.
- (c) The frontage allotted to the brigade.
- (d) The nature and amount of artillery support and whether any particular steps are to be taken as regards co-operation between the machine guns and the artillery.

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- (e) The tactical localities which it is essential should be made good during the advance.
- (f) Whether the rôle of any battalion particularly necessitates machine gun support.
- (g) Whether any special measures are to be taken by the machine guns as regards the protection of one or both flanks, or to assist in consolidation of the final objective.

2. In drawing up a plan of machine gun action in the attack, the brigade machine gun commander will be guided by the principles enunciated in Sec. 100.

The nature of the ground is a factor which he must weigh carefully. The ground will not always be equally suitable for machine gun action on the whole of the brigade front, and it will often be necessary for some or even the bulk of the machine guns to operate outside the area covered by the brigade.

3. As pointed out in Sec. 100, 4, it will often be desirable for both the forward and the supporting machine guns to operate under the orders of one machine gun commander. If, in the particular operation in hand, it is not considered practicable for the brigade machine gun commander to control the action of both the forward and the supporting machine guns, it will be necessary to allot the former to the support of definite battalions. In such cases the forward machine guns will act under the orders of the battalion commanders concerned for such period or phase of the operation as may be defined by the brigade commander and made clear to all concerned.

4. Whether the forward machine guns are acting under his orders or not, the brigade machine gun commander must be in a position to control the movements and action of the supporting machine guns.

In the initial stages of a deliberate attack it will generally be possible to allot beforehand definite tasks to these machine guns.

But as the advance progresses constant changes in the tactical situation will necessitate the intervention of some or all of the supporting machine guns on any part of the brigade front.

5. The brigade machine gun commander must take advantage of pauses in the operation to review the machine gun situation generally, to satisfy himself that the machine guns are disposed in sufficient depth, and to consider the advisability of the employment of reserve guns, of carrying out reliefs, &c. He will often find that the guns have become overconcentrated or too much dispersed in the course of the fighting, and he may have to arrange their regrouping.

6. In order that he may regulate the supply of ammunition to the machine gun platoons in accordance with the tactical situation, the brigade machine gun commander must control the movements of the brigaded machine gun ammunition limbered wagons.

CHAPTER XVIII.

MACHINE GUNS IN THE DEFENCE.

GENERAL PRINCIPLES OF EMPLOYMENT.

111. *General considerations.*

1. The principles of defence are laid down in F.S.R., Vol. II, Chapter XI.

2. A commander who decides to await the enemy's attack, before himself assuming the offensive, will economize as much as possible in the troops allotted to a defensive attitude, in order that he may have the greatest possible force available for offence.

3. Machine guns, by reason of their great fire power, will assist in effecting the economy mentioned above and will form an important part in the framework of the defence.

4. The following sections deal mainly with the disposition and action of the machine gun units detailed to form part of the force which is to act temporarily on the defensive.

The action of the machine guns allotted to form part of the force held in reserve for offensive action will follow the lines indicated in Chapter XVII.

5. Troops acting on the defensive must invariably be imbued with the offensive spirit; a merely passive defence lowers moral and reduces efficiency. An active defence, embracing a carefully organised programme of harassing fire, as well as special enterprises in co-operation with the infantry and artillery, will maintain this

offensive spirit in the machine gun detachments and ensure that the machine guns are ready to fire, and able to fire effectively, whenever an attack is launched by the enemy.

112. *Duties in the defence.*

1. The foundation of the defensive organization must be the battle position, on which the defender intends to fight out the battle and expend his last resources.

In front of this position and forming part of it there will be an outpost zone organized in depth and held in such a way as to absorb the shock of the attack, to deprive it of its momentum and to break up the enemy's organization as far as possible.

The object of the defending troops is so to wear down the fighting power of the enemy, while maintaining their own, that they will be able at a suitable time to resume the offensive.

2. The duties of machine guns in the scheme of defence will, therefore, be:—

- i. To assist the infantry in the outpost zone to check and to disorganize a hostile attack.
- ii. To assist in the defence of the battle position, should the enemy succeed in penetrating the outpost zone.
- iii. To check the advance of the enemy, whether forward or laterally, should he penetrate the battle position.
- iv. To assist the infantry and tanks in the execution of counter-attacks.

113. *Dispositions in the defence.*

1. In order that they may carry out the above duties machine guns must be *disposed in depth*. The actual depth to which the machine gun defence should be carried should normally include the main field artillery positions.

2. The disposition of the machine guns in depth must be based upon definite plans for the restriction of the area into which an attacking force may penetrate. They must be so disposed as to ensure the formation of a defensive flank in either direction in the event of a penetration of the defensive system at any point of tactical importance, and to support an immediate counter-attack for the recovery of the lost ground. They must also be distributed so that if the enemy succeeds in overcoming the forward troops, his farther advance may be checked by the machine guns in rear until the necessary measures can be taken to restore the situation. In the organization of the machine gun defences, the closest co-operation is necessary between neighbouring units and formations and between machine guns and the other arms.

3. In determining on the disposition of machine guns in the defence, due consideration must be given to the necessity for retaining a portion of the available machine guns as a mobile reserve, to be used either (a) to stiffen the defence if necessary, or (b) to co-operate with troops detailed to carry out a counter-attack. (See Sec. 120.)

4. After the reserve has been detailed, the bulk of the remaining available machine guns must be disposed for the defence of the battle position.

The troops in advance of the battle position have the rôle of outpost troops. Only a comparatively small proportion of the available machine guns, therefore, must be allotted for the immediate support of these troops; the actual number to be allotted for this purpose can only be decided after a study of the ground. These guns should usually be disposed by sub-sections and should be employed to assist in the defence of the outpost line of resistance. If it is decided not to allot machine guns for the immediate support of the troops in the outpost zone, steps should,

if possible, be taken to arrange that machine guns sited primarily for the defence of the battle position are able to cover selected tactical features in the outpost line of resistance. (See also Sec. 116.)

When the available ground is restricted, the forward portion of the battle position will sometimes coincide with the outpost line of resistance. In such cases it will generally be necessary for this line to be strongly defended by machine gun fire.

5. In position warfare few machine guns, if any, should be placed in the most forward area.

Even if machine gun detachments are accommodated in deep dug-outs near the front line, their chance of coming into action is small, since by the time they have manned their guns the enemy may have overrun the gun positions, and one of the chief characteristics of the gun—*viz.*, sustained fire—cannot be brought into play.

114. *Laying out new defences.*

When planning new defences, the fields of fire for machine guns should be laid out before the lines of the trench system are determined in detail (see F.S.R., Vol. II, Sec. 130, 4). It will then be possible to make full use of the ground with a view to the most advantageous application of machine gun fire. This method of preparing the organization of the defence is of especial importance in flat country where the field of fire cannot be increased by moving machine guns to higher ground. Care must be taken while the defences are in process of construction not to block the fields of machine gun fire which have been decided upon.

SITING OF MACHINE GUNS IN DEFENCE.

115. *General principles.*

1. No attempt should be made to site machine guns so that every yard of ground is swept by their fire. The tasks allotted to machine guns must be those best suited to their characteristics.

2. Machine gun fire should be used to cover the more important features and to deny to the enemy the most favourable routes of advance. It may be employed to stiffen the defence of areas already covered by artillery or trench mortar fire or to defend areas which the artillery cover cannot.

3. Localities of tactical importance must be strongly covered, even though it becomes necessary to leave gaps on parts of the front where an attack is less probable.

Generally speaking, machine guns should be sited so that their fire will cover the ground on which the enemy is likely to present the best targets.

4. Owing to the value of enfilade fire at close and medium ranges, the machine gun defence of a tactical feature is best ensured by placing the machine guns away from and on the flank of, rather than on, the feature. Consequently machine guns will not necessarily be sited in the area of the unit whose front they are covering.

5. The employment of machine guns singly must be avoided. If the machine gun defence were based upon the disposition of the guns singly, the loss of one machine gun might disorganise the whole system of defence. Machine guns should be employed in pairs or sections, in order to secure sufficient volume of fire, to facilitate control, and to inspire mutual confidence between the gun detachments.

116. *Fire tactics.*

1. The fundamental principle upon which the plans for defence must be based is the power of the machine gun to arrest the progress of the enemy by direct fire at medium and close ranges.

2. In addition, long range fire, preferably direct, can be used in order to harass and to break up troops advancing in close formation. It can also be used to assist in disorganising the enemy during the

opening stages of an attack if it is directed on to the most likely avenues of approach, or between the posts in the outpost zone. The employment of long range fire will be limited by :—

(a) The necessity for retaining at the machine gun positions a minimum of 2,000 rounds a gun (in filled belts) for close range fire.

(b) The undesirability of disclosing the machine gun positions.

3. Indirect fire can be employed where it is not possible to deal with the target by direct fire. This may often be the case when targets which have to be engaged at long range cannot be seen from a machine gun position, or when smoke, mist or darkness prevent any target whatever from being seen. For this reason all machine guns normally sited for direct fire must also be able to fire on their lines by indirect means if necessary.

Once the enemy has penetrated the outpost zone it will usually be impossible to engage him with indirect fire owing to the difficulties of observation of fire, and the uncertainty of his positions.

4. All the considerations contained in the preceding paragraphs must be taken into account when working out the plan of machine gun defence, and it follows that all machine guns sited in fixed positions must first be disposed in depth with the object of defending tactical features with direct fire at medium and close ranges.

When this has been done, as many of these machine guns as possible should be utilised for long range fire—direct or indirect—according to circumstances. Machine guns so employed, therefore, will have two main lines or areas of fire.

(a) The more important line, for medium and close ranges ;

(b) The long range line, which will usually entail indirect fire.

5. The general considerations governing the employment of barrage fire in the defence are laid down in F.S.R., Vol. II, Sec. 135.

If barrage fire forms part of the defence scheme, careful co-ordination is required between artillery, machine guns and mortars in the preparation of the scheme. This will entail ample time being available for reconnaissance in order to decide which areas or localities are to be covered by artillery and machine gun fire respectively.

117. *Selection of positions on the ground.*

1. Once the general distribution of the machine guns in the scheme of defence has been settled, and an approximate idea of their locations has been formed, it will be necessary to select the actual positions on the ground.

The following considerations must be taken into account:—

- (a) An extensive range along the most important line of fire is essential: if possible, this range should not be less than 800 yards, for guns sited in pairs, and not less than 1,500 yards for guns sited in sections.
- (b) The field of view should be as wide as possible, in order to enable the machine gunners to engage other targets when the most important area of fire is clear.
- (c) When the configuration of the ground permits, positions should be chosen with a view to bringing enfilade fire at medium and close ranges to bear upon likely avenues of approach.
- (d) All positions should, if possible, be capable of all round defence. For this purpose it is necessary to sweep with fire all ground within 600 yards; this will seldom be possible except by the use of alternative positions.
- (e) No rule can be laid down as to the siting of machine guns in a clearly defined trench system. Guns sited in trenches are likely to come under concentrated artillery fire, but, on the other hand, they are more easily moved and visited in daylight.

Where a position can be sited in the open without any indications (*e.g.*, tracks to the position, traces of work, shadows, &c.) being afforded to the enemy either from the ground or from the air, it may escape deliberate shelling at the outset of the attack, and the field of fire will be less restricted, especially in flat country.

The nature of the emplacement must also be considered (*see* Manual of Field Works (All Arms), Chapter V).

- (f) Provided that a reverse slope affords the required field of fire, it possesses certain advantages for machine gun positions, and approaches will not, as a rule, be subjected to ground observation.

For machine guns in rear positions, however, where concealment is less difficult, a forward slope is generally preferable, as it affords a longer field of fire.

- (g) In undulating country, valleys which lead from the enemy's positions will form likely avenues of approach. Machine guns should be posted at the heads or along the sides of such valleys, so as to command them.

When there is a valley which the enemy must cross in his advance, positions for the machine guns should be found from which it is possible to bring fire to bear on the enemy as he is crossing the ridge to descend into the valley, and also to enfilade the bottom of the valley.

- (h) Normally the field of fire inside a village will be restricted and therefore, as a general rule, only a few, if any, machine guns should be sited inside it. If, however, advantageous sites can be found, machine guns posted inside a village may prove of great value.
- (i) A machine gun should not be sited near a conspicuous or obvious landmark (*e.g.*, an isolated ruin, an isolated clump of trees, cross roads, trench junctions, &c.), nor should a

position be chosen which is likely to be subjected to heavy hostile artillery fire.

- (j) Machine guns may be sited in the cellars of a group of ruined houses, as it will be difficult for the enemy to locate their exact positions; but it must be remembered that carbon monoxide gas may render ill-ventilated emplacements untenable if much firing is carried out. Similarly, a large wood lends itself to defence by nests of machine guns, as the foliage and undergrowth give ideal facilities for concealment, even of comparatively large field works. The advance of the enemy should be diverted by well arranged obstacles and, if necessary, clearings, which are swept by machine gun fire.

In woods, valleys or depressions gas is particularly dangerous. When guns are sited in such areas, the most stringent precautions must be taken against the effects of gas.

- (k) Wire obstacles sited in connection with machine gun fire, may be classed as "tactical" or "defensive." Tactical wire should be carefully sited, with the object of forcing the enemy into definite areas or along routes upon which concentrated machine gun fire can be brought to bear. Defensive wire is that which is sited in order to afford local protection to machine gun positions; it is not necessarily covered by the fire of the machine guns it directly protects, but must be covered from neighbouring machine gun positions or else by rifle fire. It is not advisable to site a machine gun position at the apex of a wire entanglement, as the enemy is bound to suspect its presence. Only dummy emplacements should be constructed at such points; the actual gun should be in a concealed position to a flank or in rear.

- (l) In selecting a position due regard must be had to its concealment both from ground observation, and from the air. Every machine gun officer should be familiar with the principles and practice of camouflage. (See *Manual of Field Works (All Arms)*, Chapter IX.)

Combined with the skilful use of natural and artificial camouflage, mobility, alternative positions, frequent changes of position (where practicable) and dummy positions should all be employed to deceive the enemy's observers.

2. When a position is selected on a forward slope, there should be some covered approach by which access to the gun may be maintained.

Traces of occupation of an isolated position are difficult to avoid; during the day it will often prove advisable for the detachments to live at some little distance from the machine gun position, if they can reach it by a disused trench or some covered approach.

3. Machine guns should not be fired prematurely from the positions which they will occupy in the event of an attack. Alternative positions must be prepared from which to carry out harassing fire.

4. Every machine gun detachment should have with it the means for destroying the gun should necessity arise. A hand grenade placed on the breech casing is sufficient.

118. *Summary of considerations as to siting.*

The following is a summary of the considerations given in the preceding sections regarding the siting of machine guns in defence:—

- i. No attempt should be made to sweep every yard of ground by machine gun fire. Fire must be directed on to areas over which the enemy will probably advance, and must

be utilised for the defence of important tactical features, preferably obliquely or in enfilade.

- ii. All machine guns must be sited for the employment of *direct* fire at medium and close ranges, and a reserve of at least 2,000 rounds a gun in filled belts must be maintained at the machine gun position for this purpose.
- iii. Long range fire, either direct or indirect, can be employed to harass and to disorganize the enemy, but the primary duty of machine guns is that given in the preceding paragraph. The field of fire should be as wide and as deep as possible, in order that the greatest use may be made of long range fire on suitable targets. This applies especially to machine guns sited in sections.
- iv. Machine guns should rarely be sited singly, and then only for a specific purpose.
- v. The more forward machine guns should generally be sited in pairs, as this will facilitate control, tend to maintain *moral*, and enable one gun to carry on the task in the event of the other gun being put out of action. Machine guns farther in rear can usually be sited in sections.
- vi. Whenever possible, positions must be prepared for all round defence, so that the machine gun detachments can defend their position if the enemy attacks it from any direction.
- vii. Machine guns in rear can often be sited so that their fire will protect the flanks of the more forward guns, but this is a secondary consideration, and must not restrict local defence by direct fire at medium and close ranges.
- viii. The importance of adequate cover for the machine gun detachments must be remembered. It is not sound to select machine gun positions for a good field of fire in

an area which is likely to be subjected to an intense bombardment unless adequate protection is provided within a short distance of the position.

- ix. Liaison between the engineers and machine gunners must be maintained in order that the most effective use may be made of obstacles and field works.

TACTICAL HANDLING.

119. General considerations.

1. Once the enemy has launched an attack on a large scale the action of the machine guns, other than those in reserve, will be governed by the tasks allotted to them beforehand in the plan of defence.

2. The failure of all telephonic or telegraphic communication with the more forward gun detachments must be anticipated. Machine gun defence in the forward area will probably develop into a series of minor actions each involving the most stubborn defence of important tactical features. So far as the machine gun detachments allotted to the defence of a position are concerned, any position they are ordered to defend must be held to the last, or until they receive orders to withdraw. As long as machine gunners are still holding out, no position can be regarded as lost, and the delay thus caused to the enemy's attack may gain time for the development of a successful counter attack. If the gradual withdrawal of the more forward machine gun detachments is ordered by superior authority, their movements should be covered by the infantry.

3. In order to overcome the difficulties caused by loss of inter-communication, and to obtain information as to the dispositions of the defending and attacking troops, active reconnaissance must be carried out and close liaison maintained by the machine gunners with the artillery and the infantry.

120. *Action of the reserves.*

1. In all plans for counter-attack, whether drawn up beforehand or made on the spur of the moment, the covering fire of machine guns, preferably firing direct and from a flank, must be included.

Previous reconnaissance in close conjunction with infantry commanders should enable machine gun commanders to determine approximately the areas in which counter-attacks may have to be delivered. The latter will then be able to select positions from which direct observation of the counter-attacks may be possible.

2. When time is available, positions must be prepared for reserve machine guns, generally in the rear zone of the battle position. Normally the reserve machine guns will occupy these positions directly the hostile attack materialises, but they must retain their mobility in order that they may be able to move quickly when required either to protect the flanks or to support troops detailed to carry out a counter attack.

It is possible that restrictions of time and labour may prevent the rear systems of defence from being fully prepared in all details. Should the enemy penetrate rapidly into the defended area, many of the defences to be occupied in a rear system may be in the nature of improvised defences. In this case, full use must be made of villages, houses, woods, hedges, broken ground and ditches, in order to conceal the defensive dispositions.

In the defence in position warfare it must be remembered that after penetrating for some distance into the defended area, the enemy's artillery will, for a time at any rate, be somewhat disorganised, his heavy guns will not have been moved up and registration will not have been carried out. Positions can, therefore, be occupied which would otherwise be untenable.

3. It will frequently happen, when the available reserves are few, that machine guns will, in the first instance, form the principal

garrison of rear systems of defence. Under these circumstances machine gun detachments must be prepared to point out to the infantry the prepared positions in the rear system.

4. It is of extreme importance that machine guns which may be required to man rear systems of defence, should carry out thorough reconnaissances of the positions which they may have to occupy, and of the ground in the vicinity. Such reconnaissances should be made both by day and by night.

121. *Retirements.*

1. Although the enemy's advance does not necessarily entail the withdrawal of the machine guns, it may happen that such a withdrawal has to be carried out to conform with the movements of troops on the flanks. It is essential, therefore, that plans for a possible withdrawal should be prepared beforehand and communicated confidentially to responsible commanders only.

2. The success of any such operation will depend upon :—

- i. The plan being communicated to, and thoroughly understood by, all concerned.
- ii. Close liaison between machine gun, infantry and artillery commanders.
- iii. The determination of all ranks that the enemy must be made to suffer heavy casualties for any gain of ground which he may make.

When moving from one position to another, machine gun detachments must be assisted by covering fire from the infantry, as machine gunners cannot move their equipment and use their rifles at the same time. In a withdrawal, the infantry escort forms an important factor in successful machine gun work.

122. *The machine gun platoon operating with its battalion.*

1. A comprehensive plan for the action of machine guns is of such value in the general scheme of defence for a force of all arms, that it will only be expedient to leave machine gun platoons with their battalions when circumstances render it impracticable to prepare such a plan.

The occasions on which such circumstances will arise may be summarized as follows :—

- i. A single battalion may be detailed to cover the front of a brigade.

In such a case the battalion will be performing the rôle of outpost troops and the disposition of the machine gun platoon will be made on the lines indicated in Sec. 95.

- ii. When time is not available for the detailed reconnaissance which is necessary before a comprehensive plan of machine gun action can be prepared.

- iii. When a brigade has to occupy such an abnormally wide frontage that there can be little depth in its dispositions.

In the case of either (ii) or (iii) above, the machine gun platoons of the battalions in first line must be disposed by battalion commanders in accordance with the principles enunciated in the preceding sections, care being taken that co-ordination of machine gun effort is arranged for on the flanks of the neighbouring battalions.

2. Before he can submit a plan for the dispositions of the machine gun platoon, which must be based on the principles in the preceding sections, the platoon commander must be furnished with information on the points mentioned in Sec. 91, 4, and must know what proportion (if any) of the platoon the battalion commander intends to retain as a mobile reserve.

123. *Machine gun platoons brigaded.*

1. When he decides to adopt a comprehensive plan for the action of the available machine guns, a brigade commander must consider the brigade sector as a whole and make an allotment suitable to the *ground* irrespective of the actual frontages allotted to battalions.

The protection of one or both flanks, or the nature of the ground, will often make it necessary to allot a larger number of machine guns to the defence of the area occupied by one battalion than to that occupied by another battalion.

2. Having received information on the points mentioned in Sec. 91, 4, and as to the proportion (if any) of the available machine guns which the brigade commander intends to retain as a mobile reserve, the brigade machine gun commander, after carrying out the necessary reconnaissance, will submit a plan for the disposition of the machine guns in accordance with the principles already enunciated.

3. The brigade machine gun commander must ensure that battalion commanders are fully aware of the nature and amount of machine gun support which is to be afforded to their battalions. He will also be responsible for working out, in conjunction with the artillery staff, the technical details which are necessary to ensure co-ordination of machine gun and artillery fire.

APPENDICES.

APPENDIX I.

RANGE TABLES.

*Tangent angle, angles of descent, dimensions of cones and zones, &c.
 .303 Vickers gun, Mark VII ammunition.*

1	2	3		4	5		6		7
Range (Yards).	Tangent angle (Minutes).	Slope of Descent.		Height in Yards of Lowest Shot below Centre of Cone.	Dimensions in Yards of Horizontal Beaten Zones.		Dimensions of Cones in Yards.		Time for effect in seconds at 250 rounds a minute.
		In Minutes.	As a Gradient.		Width.	Length.	Width.	Height	
					90 p.c.	90 p.c.	90 p.c.	90 p.c.	
100	3	—	—	—	—	—	—	—	
200	7	—	—	.7	—	—	—	—	
300	11	—	—	1.0	—	—	—	—	
400	16	15	230	1.3	—	—	—	—	
500	22	23	149	1.7	2.3	700	2.3	3.3	
600	28	32	107	2.0	2.8	600	2.8	4.0	
700	35	42	82	2.3	3.3	525	3.3	4.6	
800	43	54	64	2.7	3.8	450	3.8	5.3	
900	52	69	50	3.0	4.3	375	4.3	6.3	
1000	62	88	39	3.3	5.0	300	5.0	7.3	

RANGE TABLES—continued.

1	2	3		4	5		6		7
Range (Yards).	Tangent angle (Minutes).	Slope of Descent.		Height in Yards of Lowest Shot below Centre of Cone.	Dimensions in Yards of Horizontal Beaten Zones.		Dimensions of Cones in Yards.		Time for effect in seconds at 250 rounds a minute.
		In Minutes.	As a Gradient.		Width.	Length.	Width.	Height	
1100	73	111	31	4.0	6.0	270	6.0	8.3	6
1200	86	139	25	4.7	7.0	240	7.0	9.6	6
1300	101	172	20	5.3	8.0	210	8.0	11.0	8
1400	117	209	16	6.0	9.0	180	9.0	12.6	9
1500	135	251	14	6.7	10.0	160	10.0	14.3	11
1600	155	298	12	7.3	11.3	150	11.3	16.3	13
1700	177	350	9.8	8.0	12.7	145	12.7	18.6	17
1800	201	407	8.5	8.7	14.0	140	14.0	21.3	21
1900	227	469	7.3	9.3	15.3	135	15.3	24.0	25
2000	256	541	6.4	10.0	16.7	130	16.7	27.3	31
2100	288	623	5.5	13.3	18.0	140	18.0	31.3	41
2200	322	715	4.8	16.7	19.3	150	19.3	36.0	54
2300	360	817	4.2	20.0	20.7	160	20.7	42.0	71
2400	401	929	3.7	25.0	22.0	170	22.0	50.0	91
2500	447	1052	3.3	30.0	23.3	180	23.3	59.0	116
2600	496	1186	2.9	35.0	25.0	190	25.0	70.0	147
2700	551	1332	2.6	41.7	26.7	200	26.7	83.0	185
2800	610	1491	2.3	48.3	28.3	210	28.3	96.0	232

Time of flight.

Time of Flight in Seconds.	Distance Traversed in Yards.
1	600
2	1,000
3	1,300
4	1,550
5	1,775
6	1,950
7	2,100
8	2,225
9	2,350
10	2,450
11	2,550
12	2,625
13	2,700
14	2,775
15	2,840

Note.—The time for effect (Range Table, Col. 7) is based on the slope of descent and the size of the Beaten Zone at each particular range, a rate of fire averaging 250 rounds a minute and a target 6 ft. high.

The figures are arrived at in the following manner:—

Example:—

Range. 1,200 yards.

B. Z. = $240 \times 7 = 1,680 \times \frac{2}{3}$ sq. yards.
= 1,260 sq. yards.

Slope of Descent = 1 in 25 = 2 in 50.

Height of target = 2 yards.

\therefore 1 bullet renders 50 sq. yards dangerous, assuming 1 bullet a yard of front to be sufficient.

$\therefore \frac{1260}{50} =$ number of bullets required to make the Beaten Zone dangerous (i.e. effective).

cannot

of guns
of view,

falling

300	2800
-----	------

79	.82
83	.86
89	.91
96	.96
97	.98
1	1

93	1.02
97	1.06
17	1.12
28	1.22
45	1.34

which the
yards is
an under
slope will

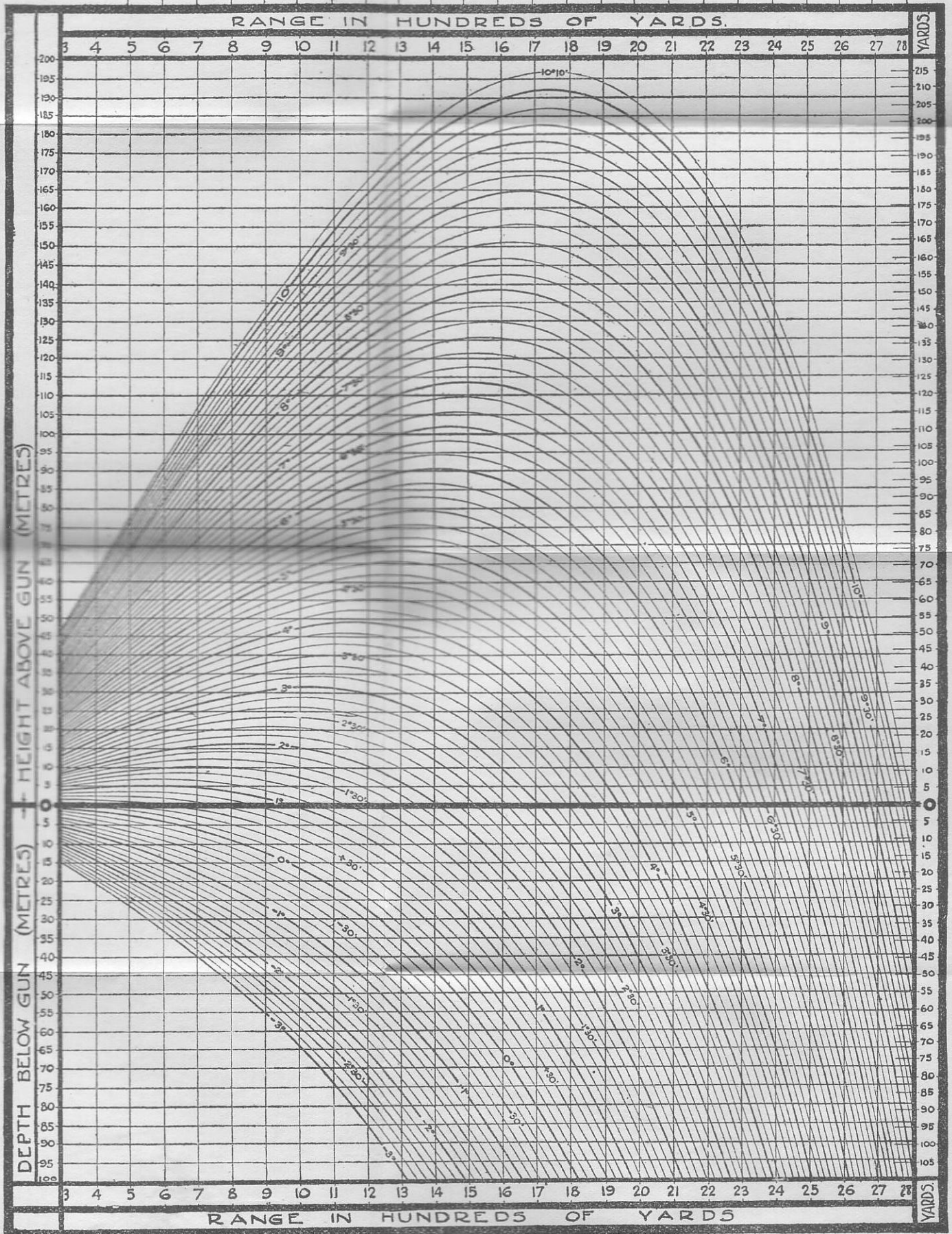
be 100 x 0.15 = say, 100 yards.

TRAJECTORY GRAPH FOR CALCULATING QUADRANT ANGLE AND CLEARANCES.

(CURVES REPRESENT CENTRE SHOTS.)

DEPTH OF LOWEST SHOT BELOW CENTRE OF CONE AT VARIOUS DISTANCES FROM GUN.

IN YARDS	17	20	23	27	30	33	40	47	53	60	67	73	80	87	93	10	133	167	20	25	30	35	42	48
IN METRES	1.6	1.8	2.1	2.5	2.7	3.0	3.7	4.3	4.8	5.5	6.1	6.7	7.3	8.0	8.5	9.1	12.2	15.3	18.3	23	27	32	38	44



10	10	10	10	12	14	16	18	21	25	28	32	37	42	48	55	63	73	CLEARANCE IN METRES	
11	11	11	11	13	15	17	20	23	27	31	35	40	46	53	60	69	80	CLEARANCE IN YARDS	

MINIMUM CLEARANCES REQUIRED AT VARIOUS DISTANCES FROM GUN.

HOW TO USE THE GRAPH.—To FIND Q.A.: Take range and run up on vertical scale to height of target above or below gun. The curve cutting this point gives required Quadrant Angle.

TO FIND CLEARANCE.—Follow this curve along, and ascertain at what height it passes vertically above a point plotted to show distance and height (above or below gun) of own troops (or obstruction). This gives clearance in yards (right-hand scale), or metres (left-hand scale), from centre shot to ground.

= 25 bullets.

= 6 secs. at a mean rate of 250 rounds a minute.

No figure lower than 6 secs. is taken, as less than 25 rounds cannot be considered a Service burst of fire.

This column will be useful in estimating the number of guns and the length of burst necessary, from a technical point of view, to obtain effect in a reasonable time at any given range.

APPENDIX III.

INFLUENCE OF GROUND UPON BEATEN ZONES.

For explanation of this table see Chapter VIII, Sec. 49.

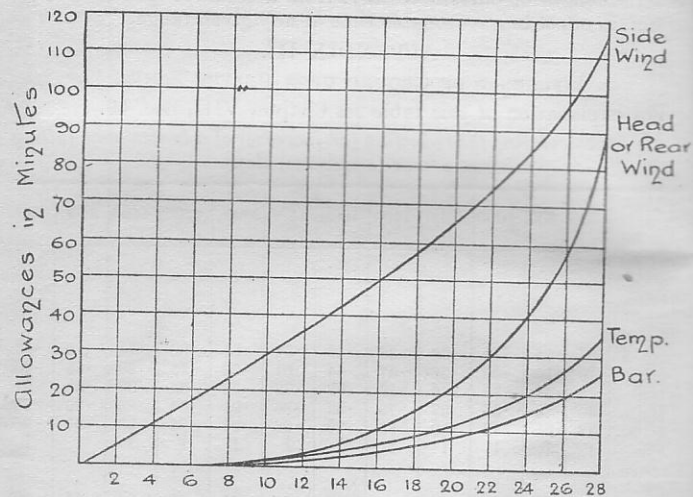
Table for calculating the reduction (or increase) of a beaten zone falling upon a near (or reverse) slope.

Range in Yards.	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800
<i>Gradient of Ground.</i>												
<i>Near</i>												
<i>Slope—</i>												
1/8-5	·07	·12	·18	·28	·38	·46	·54	·61	·68	·74	·79	·82
1/12	·10	·16	·26	·36	·47	·54	·61	·68	·75	·80	·83	·86
1/20	·16	·21	·32	·46	·59	·67	·72	·78	·83	·87	·89	·91
1/50	·30	·40	·56	·67	·76	·82	·86	·91	·94	·95	·96	·96
1/100	·48	·61	·73	·80	·85	·89	·92	·94	·95	·96	·97	·98
Flat	1	1	1	1	1	1	1	1	1	1	1	1
<i>Reverse</i>												
<i>Slope—</i>												
1/100	...	...	1·60	1·30	1·20	1·13	1·09	1·07	1·05	1·04	1·03	1·02
1/50	...	...	...	...	1·50	1·33	1·22	1·16	1·13	1·09	1·07	1·06
1/20	...	...	...	...	...	...	1·74	1·45	1·32	1·22	1·17	1·12
1/12	...	...	...	...	...	...	...	2·13	1·67	1·42	1·28	1·22
1/8-5	...	...	...	...	...	...	...	...	2·22	1·81	1·45	1·34

*Example (near Slope).—*Range 2,000 yards; gradient of near slope on which the shots are falling, is found to be 1 in 20; the beaten zone at 2,000 yards is 130 yards long; from the table, the factor in the vertical column under "2,000," opposite "near slope $\frac{1}{20}$ " is 0·78. The beaten zone on the slope will be $130 \times 0·78 =$ say, 100 yards.

APPENDIX IV.

GRAPH OF ALLOWANCES FOR CLIMATIC VARIATIONS.



Range in Hundreds of Yards.

Side wind curve
 Head or rear wind curve } are for 20 miles an hour wind.
 Temperature curve is for a variation of 20° from normal (60° F.).
 Barometer curve is for a variation of 1 inch from normal (30 inch).

lique from

= - 12'

= 18'

= - 16'

= - 46'

... - 50 light.

APPENDIX V.

Scale for the conversion of OBLIQUE bases to TRUE bases.

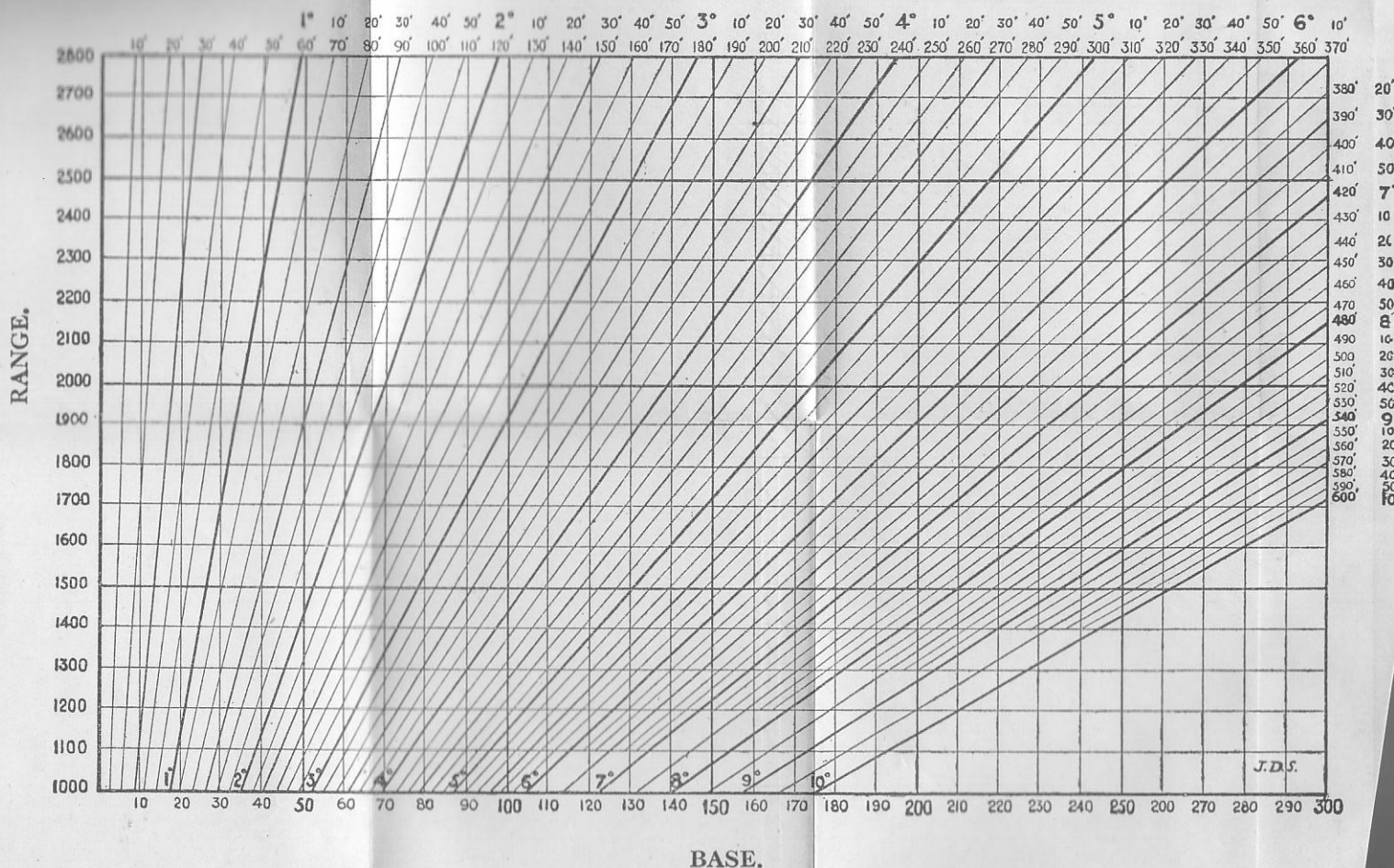
Example:—Base 80x long at an angle of 125°.

From scale, 75 % of oblique base equals true base, which is 60x.

V. I. GRAPH.

The Angle is shown by the diagonal line nearest to the point of intersection of the required base line (vertical) and the (horizontal) Range line.

Note.—Both base and Range must be taken in the same unit of measure: *e.g.*, both in yards or both in metres.

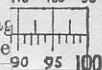


face page 303.

x.

V. I. GR 110° 100° 90°

The Angle is shewn by the diag
of intersection of the require



Allowances in Minutes

Side
Heav
Tem
Baro

EXAMPLE.

Range 2,000x. Bar. 28.5" Temp. 90° F. Wind oblique from
Right Rear, 30 m.p.h.

Elevation.

From barometer curve :

Allowance for 1" variation	...	...	=	8'
∴ " " 1½"	...	...	=	12'
This must be deducted	...	...	=	— 12'

From temperature curve :

Allowance for 20° variation	...	...	=	12'
∴ " " 30°	...	...	=	18'
This must be deducted	...	...	=	— 18'

From rear wind curve :

Allowance for 20 m.p.h.	...	...	=	22'
∴ " " 30	...	...	=	33'
This must be halved as wind is oblique	...	...	=	16'
This must be deducted	...	...	=	— 16'

Total allowance for elevation = — 46'

Direction.

From side wind curve :

Allowance for 20 m.p.h.	...	...	=	66'
∴ " " 30	...	...	=	99'
This must be halved as wind is oblique	...	...	=	50'
Wind is from right ∴ Allowance is to	...	...
right	...	...	=	50' right.

APPENDIX VI.

TESTING AND ADJUSTING CLINOMETERS AND ANGLE OF SIGHT INSTRUMENTS.

(A).—*Clinometer, Vickers' 303 inch Gun Mark I.**Testing and Adjusting.*1.—*To test.*

- i. Set scales to zero.
- ii. Place clinometer on gun, elevate or depress until bubble is in centre of run.
- iii. Reverse clinometer and note position of bubble.
 - (a) If *central*, the clinometer is probably in adjustment, but confirm at, say, 10 deg. dep. and 10 deg. elevation.
 - (b) If *displaced*, this indicates that an error is present.
- iv. In the case of (b) leave the clinometer on gun and rotate minute scale until the bubble is again central, then note the scale reading.
- v. Having noted the variation from zero, halve it and set the scale to this point, *e.g.*, suppose that reader points to 20 min. E., remove clinometer and set scale to 10 min. E.
- vi. Replace on gun and proceed as in (ii) and (iii). If the bubble does not come central, repeat process.

NOTE.—When rotating minute drum always turn to the *left* last, *i.e.*, “clockwise.”

Should an error be found, it will be seen that when the clinometer is truly horizontal there will be a variation in the zero reading. This error can be noted or scales adjusted.

2. *To adjust.*

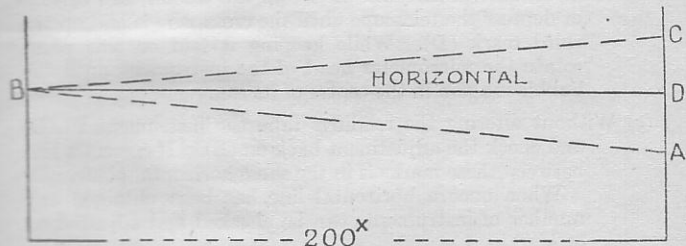
With a spanner unloose the “nuts securing micrometer collar,” set scale to zero and tighten up.

If the variation is large, it may be necessary to reset the degree reader. This is done by loosening the two securing screws and sliding reader to right or left, as may be necessary, and clamp up.

(B).—*Angle of Sight Instrument, Mark II.**To test and adjust the instrument.*

1. Lay out a horizontal line. This is done as follows:—

- (a) Select a position where there are two walls or upright posts, and about 200 yards apart, and as far as possible on the same horizontal plane. (See Diagram.)



- (b) Take the instrument to one wall (A), if possible at the corner of a house. Set the angle of sight scale to zero, direct the telescope at the other wall and bring the bubble to the centre of its run. Look through the telescope and direct someone to mark the point where the cross-wire cuts through the distant wall (B). Mark the wall where you are standing at (A) the same height as the *object glass* of the instrument.

- (c) Take the instrument to the distant wall (B) and place the object glass against the mark (B) made on it. Still keeping the angle of sight scale at zero, bring the bubble to the centre of its run. If the instrument is in adjustment the cross-wire should be in line with the mark (A) on the first wall and the line between the two marks is in a horizontal plane.
- (d) If such is not the case direct someone to mark on the first wall (A) another point (C) on which the cross-wire is laid, the bubble being central.
- (e) Make a third mark (D) on the first wall exactly halfway between (A) and (C).
- (f) With the instrument still at (B) on the second wall elevate or depress the telescope until the cross-wire is laid on the third mark (D). While keeping it laid on this point rotate the micrometer head of the instrument until the bubble is again in the centre of its run.
- (g) Without altering the readings take the instrument to (D) and check the adjustment back on (B). If correct a line between these marks is in the same horizontal plane.

When once a horizontal line has been obtained any number of instruments can be checked and adjusted on it.

2. Having now laid out a horizontal line proceed to adjust the instruments. Set the degree and minute scales to zero. Place the object glass at one end of the horizontal line and lay the right end of the cross-wire in the instrument on the point at the other end of the line laid out.

The centre of the bubble should then be in line with the horizontal cross-wire in the instrument.

3. If it is not, turn the micrometer head until it is so. Loosen the two small outer screws on the top of the micrometer head and rotate the "minute skin" until it reads zero. Tighten up the screws.

4. If the degree scale is found to be more than a few minutes off zero, it will be necessary to start afresh and manipulate the screw supporting the cased bubble until, the scales being at zero, the horizontal cross-wire in the instrument is laid on the distant point in the same horizontal plane, and at the same time is opposite the centre of the bubble.

This is a delicate operation and can only be carried out by an expert as there is danger of damaging the mechanism and smashing the bubble glass.

APPENDIX VII

Army Form W. 3786.

GROUP ORGANIZATION CHART.

Date.....

Reference.....	No.....Group.	Commanded by.....	Group H.Q.
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Group H.Q.....

[illegible]

Signature.....

Group Commander.

APPENDIX VIII

Army Form W. 3707.

Platoon or section.....	Place.....
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Ref.....

PLATOON OR SECTION CHART.

Group No..... Date.....

Unit :	No. of Directing Gun :
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Commanded by :	Frontage of platoon :
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Location of Directing Gun:	Bearing to R.O.:

Zero Line from	through	Bearing of Zero Line
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
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43	44	45
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355	356	357
358	359	360
361	362	363
364	365	366
36		

		Clock	Zero	.	u
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Time.	Time.	Position

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Flash Gun To From To

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NOTES.

[illegible]

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Signature _____

NOTES.—1. The Clearance shown must be the minimum clearance which occurs at any part of the trajectory over our own troops.

2. The Table on the left shows the angle of deviation for each gun from its zero line for any particular task.

Signature..... Platoon Commander.

APPENDIX IX.

GUN CHART.

Army Form W. 3768.

No.....Gun.
.....Platoon or section.

Gun Commander.....

Bearing of Zero Line.....

N.C.O. i/c.....

[illegible]

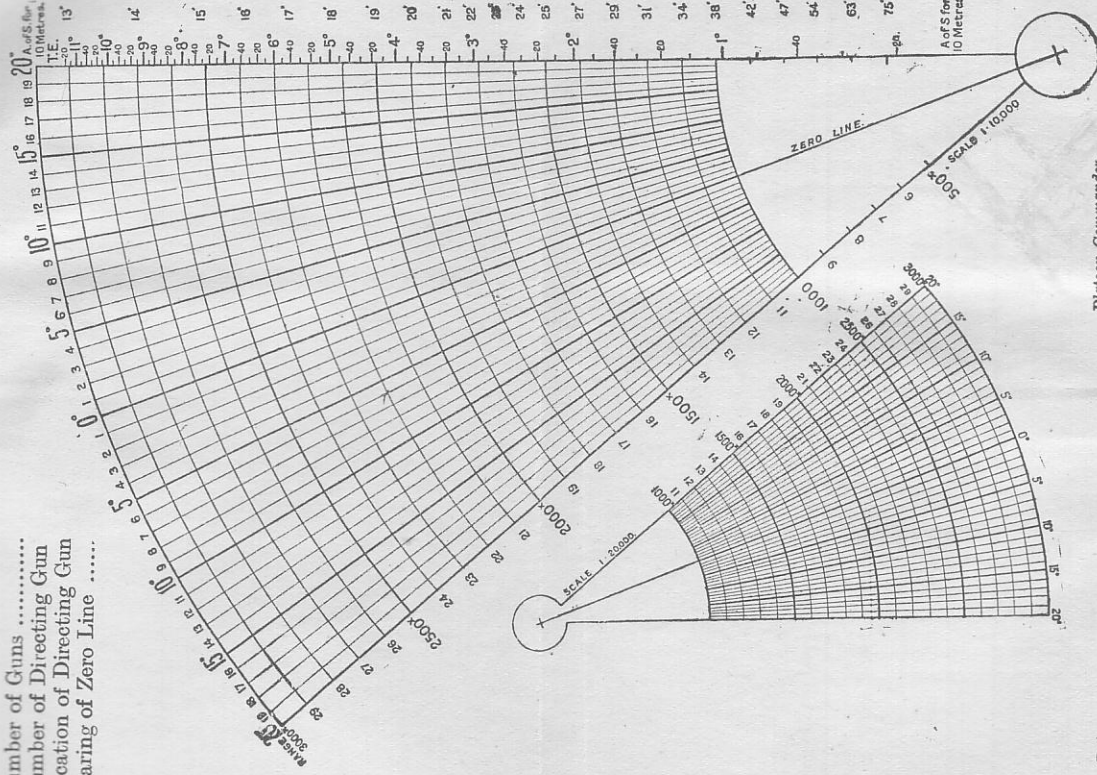
APPENDIX X.

Army Form W3700.

FIGHTING MAP.

PLATOON. Ref. Map.

Number of Guns
 Number of Directing Gun
 Location of Directing Gun
 Bearing of Zero Line



Data.....Platoon Commander

APPENDIX XI.

Night firing lamp. (Figs. 60 and 61.)

The lamp is specially designed to withstand rough usage in the field. The oil well is of the unspillable pattern.

The wick is adjusted from the outside and the flame cannot be blown out when the lamp is closed.

The glass is $\frac{1}{4}$ inch thick, and is double frosted except behind the bullseye, which can be pushed up to allow of inspection of the flame.

The lamp is fitted to a small bracket on the target post, thus allowing the height to be adjusted according to the slope of the ground.

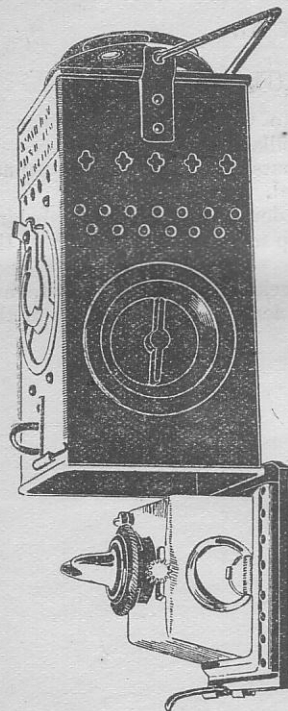


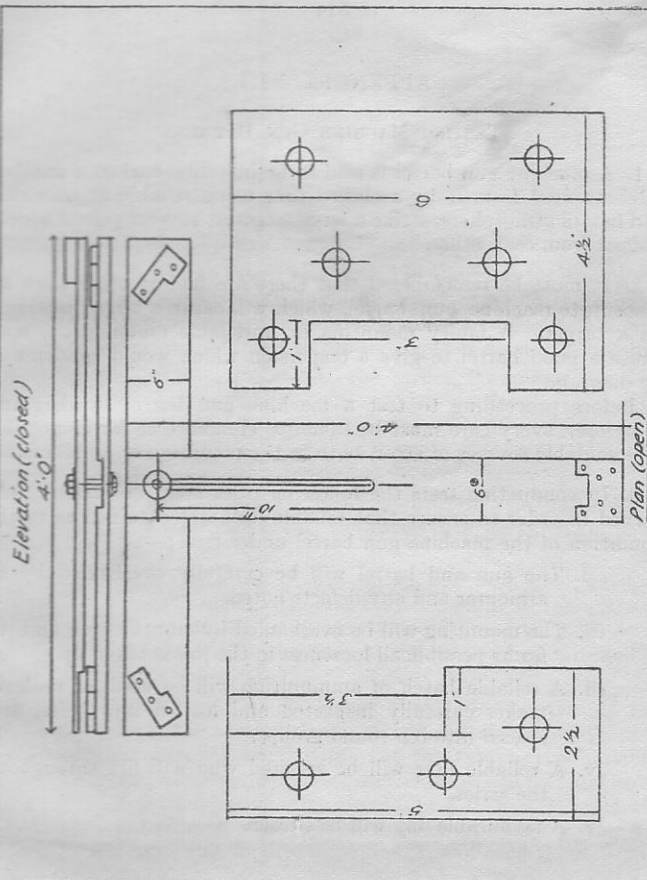
FIG. 60.



FIG. 61.

T. BASES.

APPENDIX VII.



APPENDIX XIII.

TESTING MACHINE GUN BARRELS.

1. A machine gun barrel is said to be inaccurate when a number of shots fired from it by a skilled firer using reliable ammunition and in still atmosphere, strike a large target at several points widely distant from each other.

2. It must be remembered that there are factors other than an inaccurate machine gun barrel, which will cause a large dispersion on a target. A faulty mounting or unreliable ammunition, may cause a good barrel to give a dispersion which would condemn it by diagram.

Before proceeding to test a machine gun barrel by diagram, therefore, every care must be taken to eliminate as far as possible all avoidable sources of error, both in the mounting or ammunition.

3. In conducting tests the following rules must be carefully observed in order to ensure that reliable data are obtained as to the condition of the machine gun barrel under trial:—

- i. The gun and barrel will be carefully overhauled by an armourer and any defects noted.
- ii. The mounting will be overhauled by an armourer and as far as possible all looseness in the joints taken up.
- iii. A reliable batch of ammunition will be used, of uniform make, carefully inspected and loaded into belts, and spaced into ten round groups.
- iv. A reliable firer will be selected who will fire throughout the series.
- v. A favourable day will be chosen.

- vi. The tripod will be mounted on the normal position.
- vii. The distance will be 500 yards.
- viii. A square target of not less than eight feet side and covered with white paper will be used.
The target will be carefully ruled off into squares of one foot side, and a suitable black aiming mark, *e.g.* a square of black paper of one foot side will be provided.
- ix. Aim will be taken as directed in the rules for aiming, and the elevation used will be noted. Should there be any lateral effect due to wind, it may be necessary to move the aiming mark to the right or left as may be required.
- x. Before applying fire to the target, 30 rounds should be fired through the gun directed at a point on the stop butt alongside the target in order to settle down the mounting.
- xi. Fire can now be directed at the aiming mark, and a burst of ten rounds fired.
The ten rounds must be fired in one burst, should any stoppage occur, the target will be patched out and the practice repeated.
- xii. When the firing of the group has been completed, the target will be examined to ascertain if there are ten clean shot-holes visible. Should there be more or less than ten hits the target will be patched out and the practice repeated.
- xiii. If there are ten shot-holes visible the position of these hits will be recorded carefully, by measuring from the bottom left-hand corner of the target, the horizontal and vertical distance of each shot-hole in feet and inches, and transferring same direct to A.F. B 202, or, preferably, entering in a note-book in two columns giving horizontal and vertical measurements of each shot.

The position of the "point aimed at" must also be recorded in the same manner.

xiv. Three diagrams will be taken with each barrel to be tested.

4. The "figure of merit" of the barrel will then be computed in the following manner :—

i. The position of each shot will be plotted on A.F. B 202 measured from the left-hand bottom corner of the diagram according to the measurements taken down.

Each shot will be numbered consecutively one to ten, and at the same time the horizontal and vertical measurements will be entered in feet and decimals of a foot to two places, in the column provided for the purpose.

ii. Similarly, the position of the "mark aimed at" will be plotted on the diagram and marked "X," and its measurements entered in the space provided.

iii. Each column will then be totalled and the means found. The point of intersection of the line representing the mean horizontal and mean vertical positions of the group, will give the position of the "point of mean impact." This point will be marked on the diagram thus ⊙.

iv. A rectangle will now be drawn which just embraces the group of ten shots, and the horizontal and vertical measurements entered in the summary.

v. The distance of each shot from the "point of mean impact" will now be measured and entered consecutively in the column headed "deviation from point of mean impact." The mean of the deviation gives the "figure of merit" of the barrel. The "figure of merit" will show the

accuracy of the barrel. When the average of the "figures of merit" of three diagrams exceeds 1.5 feet, the barrel will be reported as inaccurate.

5. The various headings of A.F. B 202, will be filled up giving full particulars regarding the mark, source of manufacture of the gun and barrel, and the mark, date, and place of manufacture of the ammunition.

The direction and strength of the wind should be noted, but its effect on a group of ten shots, individually, is so small as to be negligible.

By the above method it is possible to compare the relative steadiness of different mountings, provided that gun, barrel and ammunition are known to be reliable.

Also, by ensuring that gun, barrel and mounting are reliable, it is possible to compare the various brands of ammunition.

APPENDIX XIV.

ORGANIZATION OF MACHINE GUN BARRAGE FIRE.

1. The effectiveness of a machine gun barrage will depend principally upon the following factors :—

- i. *The dangerous space of the bullet.*—This will vary greatly with the range employed and, in a lesser degree, with the slope of the ground (see Sec. 49).
- ii. *The number of rounds fired a minute.*—Because the less the number fired, the less the chance of damaging the enemy while he is passing through the beaten area, and *vice versa*.
- iii. *The speed of enemy advance.*—Because the quicker he passes through the beaten area, the fewer the bullets he will meet in that time, and *vice versa*.
- iv. *The frontage allotted to each gun.*—This will affect the density of the barrage. The greatest frontage which should normally be allotted to each gun is 50 yards. If there are not sufficient guns to cover the whole line to be barraged on a frontage of 50 yards (or less) per gun, it becomes a matter for consideration whether it would not be better to apply an effective barrage to the more important parts of the line, leaving gaps to be dealt with by co-operation of other arms, rather than to put down what might prove to be an ineffective barrage over the whole line.

2. *Rates of fire.*—To prevent waste of S.A.A., to ensure time for re-laying and oiling (thereby prolonging the life of the gun), and to enable estimates of S.A.A. to be made in advance, rates of fire must be laid down for rigid observance by each gun.

Normal rates of fire are :—

- i. *Slow fire:* 60-75 rounds a minute. This is the rate for long period barrage fire.
- ii. *Medium fire:* about 125 rounds a minute. This is the rate that can be used to speed up slow fire for short periods. It can be maintained for about half an hour, and should not be attempted for a longer period.
- iii. *Rapid fire:* 250-300 rounds a minute. This rate is used when the situation demands it, but should only be maintained for a few minutes, after which the fire should be reduced to medium or slow rate.
- iv. *Harassing fire:* 1,000 rounds an hour. This may be carried out in bursts at slow, medium, or rapid rates.

Before ordering rates of fire, the following factors must be considered :—

- (a) Tactical requirements of the barrage.
- (b) Frontage of machine gun.
- (c) Time during which the barrage is to be fired.
- (d) Rate at which belts can be filled.*
- (e) Wear and tear of machine guns.

3. *Frontal, oblique, and flanking barrages.*—The fact that a barrage may be oblique or flanking does not affect the frontage which can be engaged by each machine gun, other things being equal.

The frontal barrage is the most common form, as it is usually easier to arrange and control: it has the disadvantage that the safety of our own troops may require that the barrage should not be put down nearer than 300 or 400 yards in front of them. This disadvantage may be overcome in certain cases by clearing our own troops out of the line of fire a short way on either side.

* Note.—This consideration will not apply when factory filled (stripeless) belts become available.

The flanking barrage may be put down much closer to our own troops than the frontal barrage, but owing to difficulty in siting machine gun positions, it cannot often be employed.

The oblique barrage has the advantages and disadvantages of the frontal and flanking types according to the degree of obliquity.

Frontal and oblique barrages require traversing; the flanking barrage does not. Two parallel flanking barrages about 60 yards apart should be employed rather than a single flanking barrage from the same total number of guns.

Box barrages are frequently required for such purposes as raids, &c. These barrages can be obtained by a combination of frontal with oblique or flanking fire.

4. An example of a small barrage scheme worked out from the map is given below.

In the following example it is not possible to give more than a brief outline of the procedure adopted in organizing even a small barrage. Many tactical considerations will arise necessitating close reconnaissance on the ground, which cannot be discussed here. It may, however, suggest the general lines on which to work.

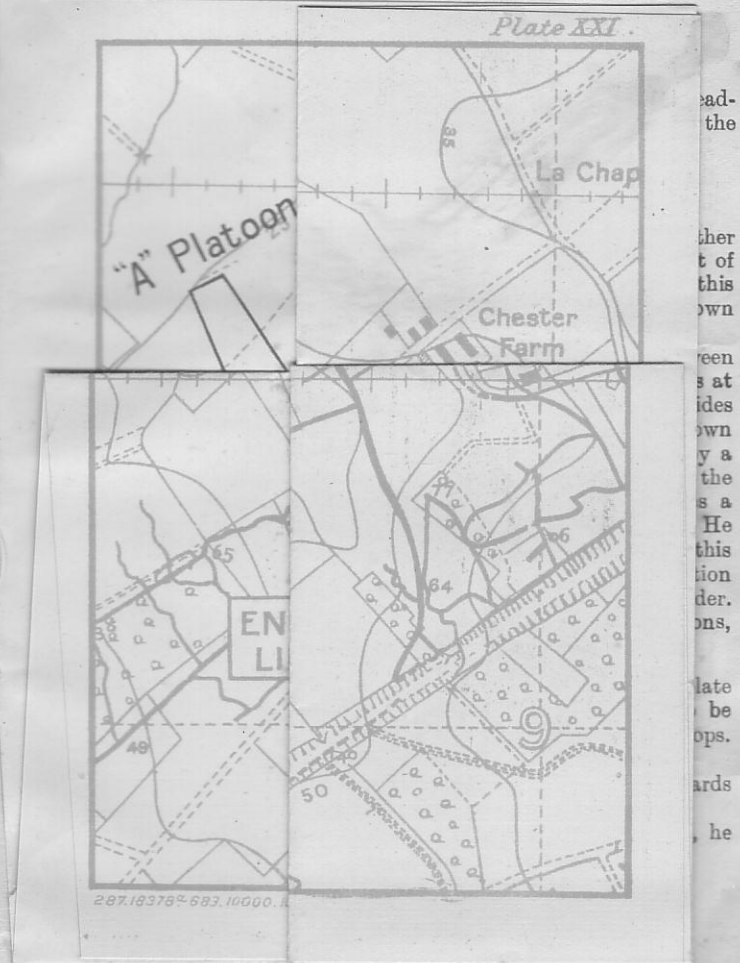
(A.) *General remarks.*

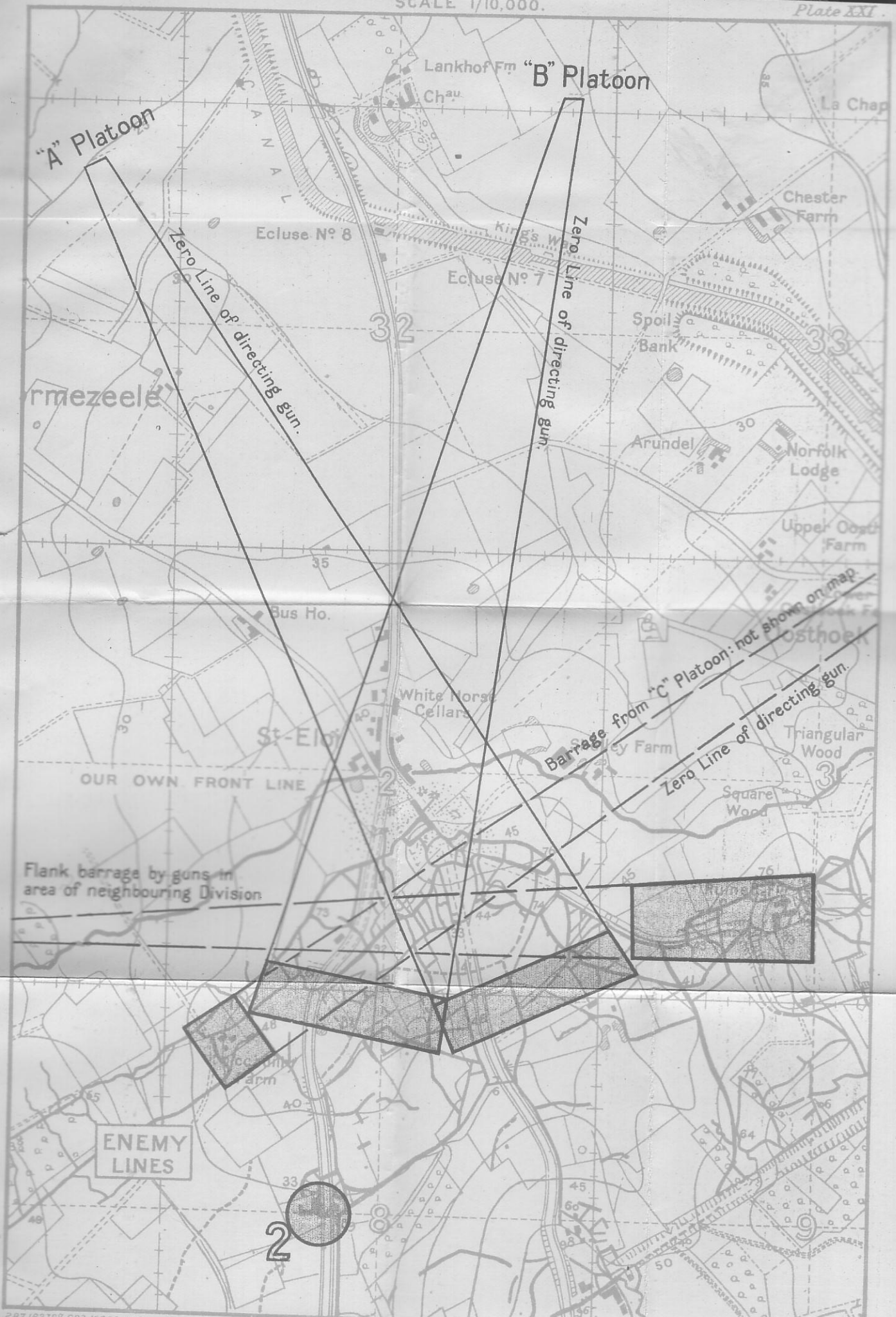
5. Our own and the enemy trenches are as shown in Plate XXI. A night raid is contemplated on the craters between the lines south of St. Eloi with the following objects:—

- i. To obtain identifications, capture prisoners and inflict casualties.
- ii. To destroy the enemy works and emplacements.

6. The machine gun group commander receives instructions to put down a machine gun barrage to effect the following purposes:—

- i. To prevent reinforcements reaching the salient.
- ii. To keep down hostile fire.
- iii. To block the trenches on either side of the salient.





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iv. To be prepared to engage with intense fire, certain head-quarters and strong points, after the termination of the raid.

(B.) *Action by machine gun group commander.*

7. Considering the problem of how to block the trenches on either flank, it is doubtful, owing to the proximity of our line to that of the enemy, whether a frontal barrage can be employed for this purpose, which will allow a sufficient clearance over our own trenches.

An inspection of the map confirms this. The distance between the lines is only about 250 yards, and the shots would not pass at a sufficient height over our own trenches. He therefore decides to employ enfilade barrages to form these blocks, which are shown in Plate XXI. That on the right flank can be put down by a platoon ("C") whose position is off the map, but within the divisional area. He finds that on the left flank it necessitates a gun position which falls within a neighbouring division's area. He therefore arranges for the division on that flank to carry out this task, and sends particulars of the area to be engaged, times, duration of fire, rates of fire, &c., via his divisional machine gun commander. (The positions of these blocks, and the lines of fire from the platoons, are shown in Plate XXI.)

8. He then considers the location of the barrage required to isolate the salient; this should be as close as possible to the line to be raided as is consistent with the safety of our own raiding troops. Their most advanced position will be the line of the craters.

The gun positions must therefore not be more than 2,000 yards from the craters. (See rule ii for Indirect Overhead Fire.)

Using his knowledge of the ground and existing conditions, he begins by choosing a suitable gun position at "A."

9. He now considers how close the barrage from this gun position can be placed in front of our own troops. By inspection of the map (Plate XXI) he sees that the most advanced point to which our own troops will reach will probably be the crater at 2.d.33.80; the distance of this point from the gun position is 1,700 yards, and it lies 20 metres above the gun position. The safety clearance required at 1,700 yards is 48 metres; by reference to the graph he finds that the curve representing $5^{\circ} 30'$ Q.A. passes at 49 metres above a point which is 20 metres above the gun and 1,700 yards from it. On the graph this trajectory cuts the zero line at a point approximately 500 yards beyond our own troops. At this point on the map, however, the ground is 15 metres above the gun position; looking again at the graph, he finds that a trajectory just below the $5^{\circ} 30'$ trajectory would strike ground which is 15 metres above the gun position, at a range of 2,130 yards. This locates a point 2.d.74.06, and he assumes that a line drawn at right angles to the line of fire through this point will give sufficient clearance on either flank of this platoon's task, as the positions of our own troops are not so advanced on the flanks. He therefore draws a line between the points 3.c.09.23 and 8.b.29.86.

10. The total frontage to be covered is about 800 yards: the machine gun group commander therefore decides to allot this frontage equally between two platoons (as shown in Plate XXI), each of eight guns, since the conditions are similar for each. This gives about 400 yards to each platoon. The positions for these platoons (which have been located up to this stage, partly by calculation, and partly from his general knowledge of the ground, existing positions, communications, &c.) should be reconnoitred by himself, together with the platoon commanders who are undertaking the barrage, and the positions definitely fixed.

It is assumed in this case that the positions selected are found suitable.

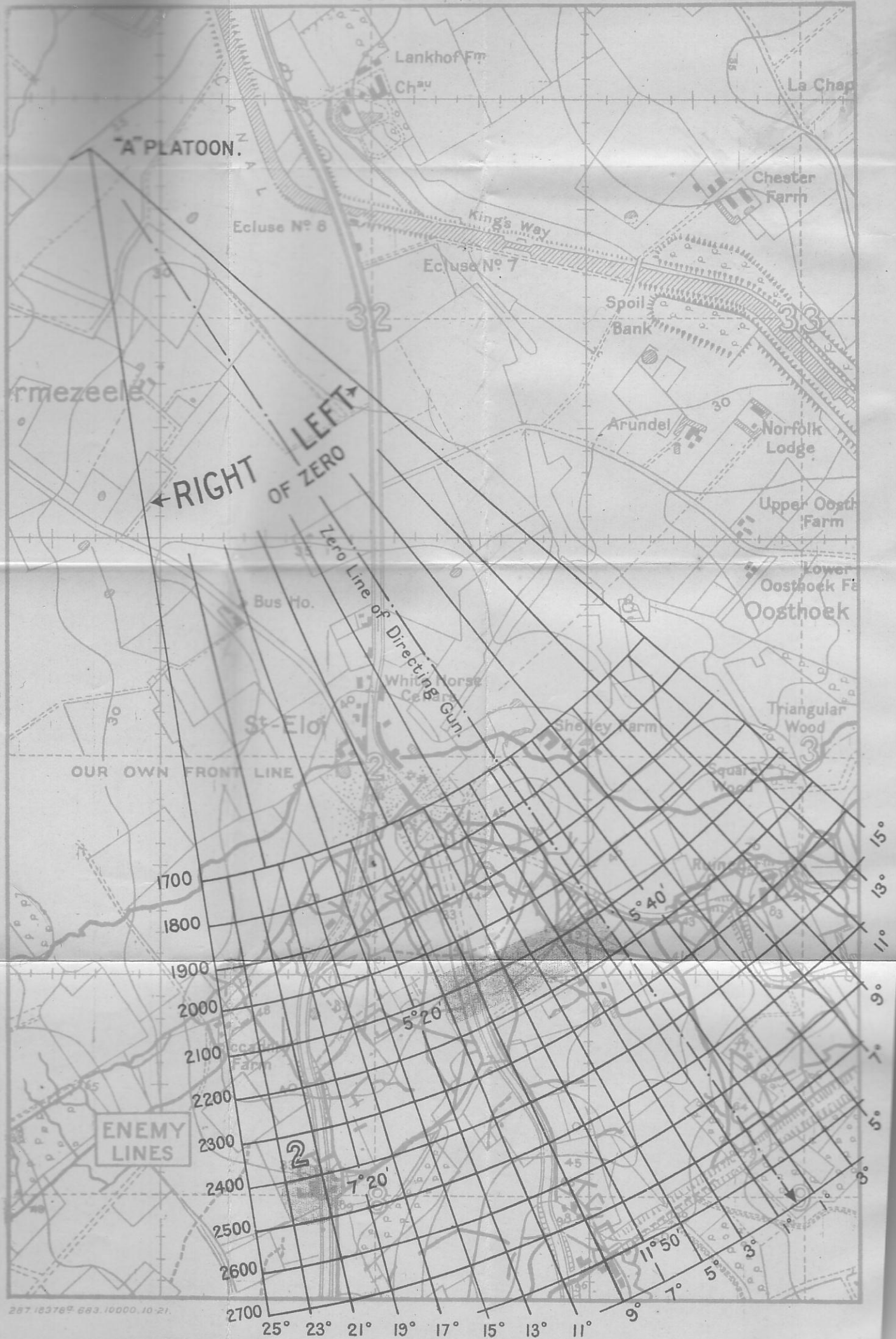
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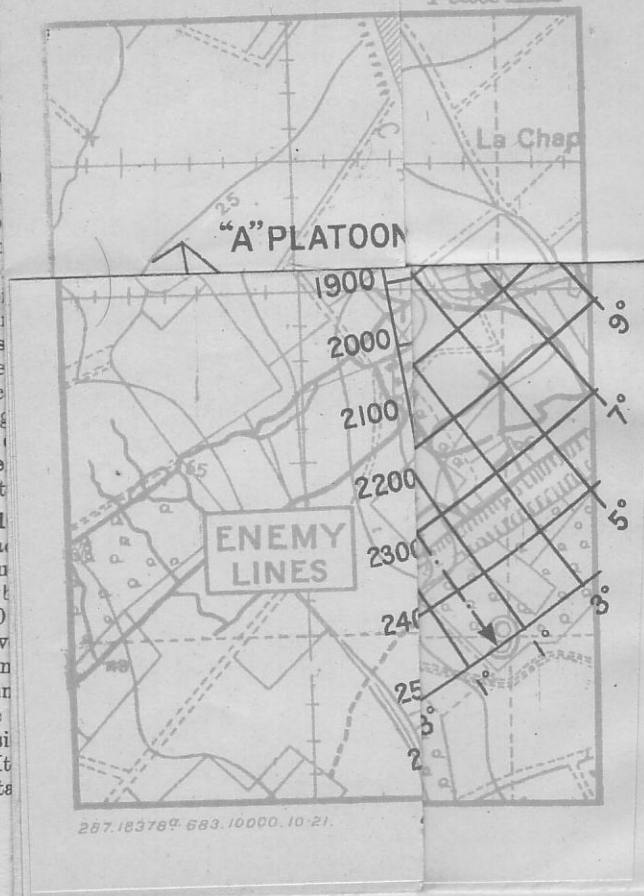
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(NOTE that the fire of "A" and "B" platoons is arranged to cross, since it will be apparent from inspection of Plate XXI that this arrangement permits of the barrage being closer to the assault line than would be possible otherwise, owing to the safety clearances over our own front trench lines.)

11. In considering the rate of fire, he decides to put down rapid fire for the period from zero to zero plus 5 minutes, to cover the first phase of the assault, and to keep down the enemy fire while our own troops are advancing. From zero plus 5 to zero plus 15 minutes, while our troops are in the craters, he fixes the rate at 120 rounds a minute, quickening to 300 a minute if the situation demands it; and from zero plus 15 to zero plus 20 minutes, at 300 rounds a minute, to cover the withdrawal.

12. The group commander now proceeds to fill in the charts for each platoon, giving only the following details:—

Commander of the platoon.

Composition of the platoon.

Location of the platoon.

Location of tasks.

Zero times, and rates of fire.

He gives these charts to the platoon commanders, who make all calculations, complete the charts, and return them to the group commander for checking. The chart and fighting map for "A" platoon are shown on page 325 and Plate XXII respectively.

(C.) *Action of platoon commander.*

13. On receipt of the platoon chart from the group commander, the platoon commander proceeds to work out the figures necessary to complete it.

For example, the calculations for "A" platoon would be as follows:—He decides that his zero line shall coincide with the left of the barrage line, No. 8 gun directing. This gives a bearing for the zero line of $146^{\circ} 30'$. There is, therefore, no angle of switch for this barrage.

Plotting the gun position on the map, he now finds the angle of distribution.

He has already found the bearing from the directing gun to the left of the target ($=146^{\circ} 30'$): that between the right gun and the right of the target is 157° . By dividing the difference between these (i.e., $10^{\circ} 30'$) by the number of gun intervals (7), an angle of distribution of $1^{\circ} 30'$ is found.

For the directing gun: Range = 2,150 yards; V.I. = + 20 metres, giving a Q.A. of $5^{\circ} 40'$.

The traverse is $1^{\circ} 30'$ right and $1^{\circ} 30'$ left.

By inspection, the clearance will be least on the line of fire of No. 5 gun, and is ascertained as follows from the graph:—

Q.A. $5^{\circ} 30'$; distance of own troops from gun = 1,700 yards; height of own troops above the gun = 20 metres; clearance of centre shot = 49 metres; minimum clearance required = 48 metres.

14. For the headquarters allotted as task 2, it will be sufficient to swing the guns round on parallel lines, and the remainder of the detail presents no difficulties.

15. In the lower portion of the chart, the angles of deviation from zero for each gun are filled in.

Under the heading "elevation," any difference in Q.A. for the various guns is recorded. In this case, guns Nos. 1 to 3 are given a Q.A. of $5^{\circ} 20'$ and guns Nos. 4 and 5 are given a Q.A. of $5^{\circ} 30'$ on account of the fall of the ground at their end of the barrage line.

GUN

P!

No. 4 Gun.

Bearing of Zero Lines : $146^{\circ} 30'$.

Task.	Clock Time.	Zero Time.	Angle of Deviation from Zero.	Q.A.
1		Z. to Z. + 20 min.	6° R.	$5^{\circ} 30'$

CONCENT

No. of Points.	Angle of Deviation from Zero.	Q
Task 2	21° R.	7

PLATOON CHART.

Map: 1/10,000 Voormezele.

Unit: "A" Platoon.

.....Regt.

Commanded by Capt. K. Cross.

Location of Directing Gun: 31.b.67.78.

Number of Directing Gun: No. 8 Gun.

Frontage of platoon: 50 yards.

Place: Voormezele. Date: 1/5/18.

Bearing of Zero Line: 146° 30'.

Method of Laying Out Zero Lines:
Compass.

Task.	Guns.	Target.	Clock Time.	Zero Time.	Angle of Switch.	Angle of Distribution.	Range.	V.I.	Q.A.	Traverse per Gun.	Rate of Fire.	Minimum Clearance.
1	8	S.b.29.86. to 3.c.09.23		Z to Z+20	0	1° 30'	2,150	+20m.	5° 40'	1° 30' R. & L.	300, 5 min.	50 m.
		STANDING BARRAGE...					2,125	+15m.	5° 20'	„	120, 10 min. 300, 5 min.	48 m.
2	8	STRONG POINT 8.a.70.02.	As	ordered.	21° R.	0	2,450	+10m.	7° 20'	1° R. & L.	300	110 m.

Task.	Angle of Deviation from Zero.								Elevation.								Remarks.
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	
1	0	1° 30' R.	3° R.	4° 30' R.	6° R.	7° 30' R.	9° R.	10° 30' R.	5° 40'	5° 40'	5° 40'	5° 30'	5° 30'	5° 20'	5° 20'	5° 20'	
2				All Guns	21° R.						All Guns	7° 20'					

(Signed) K. Cross, Capt. Commanding "A" Platoon

GUN CHART.

No. 4 Gun.

Platoon.

Bearing of Zero Lines : $146^{\circ} 30'$.

Gun Commander : L.-cpl. Euston.

Task.	Clock Time.	Zero Time.	Angle of Deviation from Zero.	Q.A.	Rate of Fire.	Traverse.	Remarks.
1		Z. to Z. + 20 min.	6° R.	$5^{\circ} 30'$	300 Z. to Z. + 5 min. 120 Z. + 5 to Z. + 15 min. 300 Z. + 15 to Z. + 20 min.	$1^{\circ} 30'$ R. & L.	300 a minute if necessary.

CONCENTRATION POINTS.

No. of Points.	Angle of Deviation from Zero.	Q.A.	Traverse.	Remarks.
Task 2	21° R.	$7^{\circ} 20'$	1° R. & L.	Rate of fire 300.

K. C., Commanding "A" Platoon.

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Gun Commander: L.-cpl. Euston.

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Rate of Fire.	Traverse.	Remarks.
300 Z. to Z. + 5 min.	1° 30' R. & L.	300 a minute if necessary.
120 Z. + 5 to Z. + 15 min.		
300 Z. + 15 to Z. + 20 min.		

Q

RATION POINTS.

14.
to swi
the de

A.	Traverse.	Remarks.
15. ° 20'	1° R. & L.	Rate of fire 300.
from z		
Und		
variou		
a Q.A.		
on acc		

K. C., Commanding "A" Platoon.

Note that small differences of Q.A. need not generally be recorded.

18. The platoon chart having been completed and checked, the platoon commander makes out a chart for each gun commander, giving those particulars from the sub-group chart that are necessary for the laying of each gun. The chart for No. 4 gun of "A" platoon is shown on page 326.

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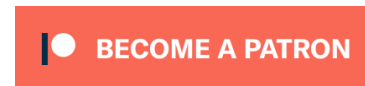
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